Title

Facilitators and Barriers to Nursing Surveillance of Instability in Hospitalized Pediatric Patients: A Grounded Theory Study

Author

Stotts, James R

Publication Date

2019

Peer reviewed|Thesis/dissertation

Facilitators and Barriers to Nursing Surveillance of Instability in Hospitalized Pediatric Patients: A Grounded Theory Study

by
James R. Stotts

DISSERTATION
Submitted in partial satisfaction of the requirements for degree of
DOCTOR OF PHILOSOPHY

in

Nursing

in the

GRADUATE DIVISION
of the
UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

Approved:

DocuSigned by:
Audrey Lyndon
2DC3ACA71B6C422...

Audrey Lyndon
Chair

DocuSigned by:
Roberta S. Rehm
[illegible]44F...

Roberta S. Rehm

DocuSigned by:
Garrett Chan
0D95D89E9C0B4E9...

Garrett Chan

Committee Members

DEDICATION AND ACKNOWLEDGEMENTS

"Our chief want in life is somebody who will make us do what we can."

— *Ralph Waldo Emerson*

It is with humble heart and deep gratitude that I acknowledge the time, resources, encouragement, and guidance of a number people who have been instrumental in reminding me that I can do this, and I can do it well.

First and foremost my partner Tim Tallerico, who in his characteristic, no nonsense style, never let me doubt myself, and wouldn't let me quit. His encouragement was the stimulus to keep going and get the work done.

My colleagues at Stanford Health Services, Garrett Chan, Cindy Day, Kathy Hickman, and Joan Mersch who supported my decision to enter the PhD program, listened as I formulated my ideas and aspirations, and kept reminding me that the work I was doing was important and valuable. Their belief in me was the wind that kept me soaring.

My qualifying exam and dissertation committee members, Audrey Lyndon, Roberta Rehm, Garrett Chan and Arpi Bekmezian, who read and critiqued my ideas and helped me see something greater than I had imagined.

My "Work in Progress" partners, Ifeyinwa Asiodu, Linda Gregory, Carrie Holschuh, Jennifer Malana, and Loretta Regan who provided me solace, encouragement, and gentle critique during the writing process. They continually reminded me I wasn't alone, and that there was light at the end of the tunnel.

Two special people require special acknowledgement. If it were not for Audrey Lyndon and Roberta Rehm, who provided thoughtful feedback to steer me, kind words to reassure me, dedicated mentorship to advise me, and insights to inspire me, I could not have finished this

work. They have truly been the beacons who helped me see the other side and believe it was possible for me to achieve.

I wish to dedicate this work to the families and nurses who generously confided in me their stories, without whom we would not be the wiser.

Finally, I am greatly indebted to the generosity of the following entities who have provided financial assistance for my PhD studies: Stanford Health System, the University of California, San Francisco Medical Center, the University of California, San Francisco School of Nursing's Graduate Dean's Health Sciences Fellowship, the Deloras Jones RN Scholarship Program, the University of California, San Francisco School of Nursing's Century Club, and the Association of California Nurse Leaders Academic Scholarship.

ABSTRACT

FACILITATORS AND BARRIERS TO NURSING SURVEILLANCE OF INSTABILITY IN HOSPITALIZED PEDIATRIC PATIENTS: A GROUNDED THEORY STUDY

JAMES R. STOTTS

Identification of patients at risk for deterioration initially started with studies that focused predictors of cardiopulmonary and neurovascular demise. This spawned research to evaluate the utility of predictor models followed by the performance studies of early warning track and trigger systems in adults. Mandates to provide emergency services early in the course of instability in the 1990s fueled research to analyze the outcomes of rapid response systems and early warning systems in both adults and pediatrics. Recently studies have looked at system and human factors that impact failure to rescue. Given the dearth of systems research in early prevention of deterioration in pediatrics this study was designed to explore what nurses do during deterioration and the factors that impact their actions.

Interview and observations of 13 pediatric nurses and 16 parents of pediatric patients admitted to a non ICU environment were conducted at one academic children's hospital in the Northwest USA. Grounded theory methods were used to guide data collection and analysis. Findings describe nursing actions associated with nursing surveillance of instability as well as factors that facilitate or impede surveillance efficacy. We present a theoretical model for how nurses and parents integrate their roles in surveillance of pediatric patients. We also further developed a sociotechnical model of nursing surveillance.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER ONE

INTRODUCTION

JAMES R. STOTTS

I first became interested in how nurses recognize deterioration as a critical care nurse working with patients on the night shift. When my patients weren't doing well, and seasoned nurses came to my aid, within seconds they were able to 'see' what was wrong and do what was needed to stabilize the patient. I marveled at their abilities, wondered what these abilities were, and how I would obtain them. A few years later as a critical care nurse educator debriefing with nurses who were orienting to critical care I started to assemble narratives from nurses about patients that deteriorated that I would later use to as exemplars of what to do and what not to do. At the time I thought clinical acumen (knowledge, skill, and experience) was all that was needed to recognize and manage deteriorating patients.

It wasn't until I worked at a clinical nurse specialist (CNS) that I began to realize that safe passage through critical care not only depended on the clinical skills of the providers, but also on the reliability of equipment, accessibility of supplies, availability of clinical resources and a number of other supports that bolstered clinical care. One of my role responsibilities as a CNS was chair of the cardiopulmonary resuscitation (CPR) or code committee. In this role we were formally researching ways to impact early recognition and expedite treatment of patient instability. One study by Franklin and Mathew (1994) was particularly memorable and thought provoking. They reported that signs of instability were evident hours before deterioration, but were missed, not treated, or undertreated by nurses and physicians. This study, along with a quip by a surgeon on the committee who opined that "patients don't suddenly code; nurses and residents just suddenly realize the patient isn't doing well" motivated me to study the phenomenon of nursing surveillance further. My sense was that nurses and residents do a lot with patients before they deteriorate which is underappreciated by this surgeon or undocumented in the current literature of the day.

As a Director over clinical practice I was fortunate to work with our Nurse Researcher to secure funds from the Gordon and Betty Moore Foundation to conduct a review of the patient surveillance literature and develop a mechanism for identifying patients at risk for deterioration. This work led us to consider the efficacy of early warning scoring systems which later became my initial focus of study once I entered doctoral studies. After considering the complexity and feasibility of comparing different predictive tools, I decided my training and educational background was more suited to a study the facilitators and barriers to nurses recognizing and managing deterioration. My review of this literature demonstrated a lack of data about what nurses actually do during patient surveillance, and a limited understanding of the factors that influence surveillance in a number of clinical practices including pediatrics. Having set the context for why I chose to study the facilitator and barriers to nursing surveillance of instability in hospitalized pediatric patients, I would now like to describe the problem, purpose of the study, its significance, and the research aims.

Problem

When children are admitted to the hospital they are generally expected to be discharged without experiencing unanticipated harm. Harm refers to an adverse event, injury or complication from a medical error or systems failure that requires additional monitoring, treatment, or results in death (Kim, Lyder, McNeese-Smith, Leach, & Needleman, 2015). Analysis of adverse events in hospitalized children reveals that up to 19% are attributed to failed escalation (Hayes et al., 2012) with 64-95% of patients demonstrating evidence of instability or nurse concern hours prior to the event (Hanson, 2010; Tume, 2007).

Nurses perform an important function in the early detection and treatment of patient deterioration through surveillance. Surveillance comprises about 20-50% of nursing activities

(Neff, Kinion, & Cristen, 2007; Shever, Titler, Dochterman, Fei & Picone, 2007). Because of their proximity and continuous interaction with patients the nurse is likely to be the first to identify risk, prevent complications and witness changes in conditions that warrant intervention. Nursing surveillance encompasses purposeful and continuous patient data acquisition, interpretation, and synthesis for the purpose of determining condition changes and impact on patient stability, as well as when and how to intervene (Bulechek, Butcher, Dochterman, & Wagner, 2013; Meyer, Lavin, & Perry, 2007; Kelly & Vincent, 2011). Although a number of models conceptualize factors that enhance or hinder nursing surveillance, studies supporting relationships between factors and outcomes of improved patient outcomes are limited.

Research thus far reveals how nurses know a patient is deteriorating. From this we can deduce what nurses watch for when they are doing surveillance. Studies also provide a preliminary understanding of actions nurses take when a patient deteriorates, and factors which help or hinder surveillance, and nurses taking action. A re-look at the definition of surveillance reveals there is more to learn about this phenomenon. The data falls short of describing the actions, facilitators and barriers of interpretation, synthesis, analysis, and decision making about surveillance intensity and when or how to intervene. Studies of family interactions with clinicians in the setting of deterioration have focused on family and clinician expectations and perceptions of one another. The barriers and facilitators that impact this interaction have not be empirically explored. There is literature that endorses the benefits of family engagement in surveillance of adverse events but as yet there is still insufficient evidence to inform its effective implementation (Berger, Flickinger, Pfoh, Martinez & Dy, 2014). A greater understanding of the context within which patient deterioration is detected and reported will provide the foundation for designing educational programs, mechanisms for collaboration, and support systems.

Study Purpose and Significance

Demonstration that early recognition and intervention in deteriorating children improves outcomes has been difficult to substantiate despite evidence that early therapy reduces morbidity and mortality in children with sepsis (Brierley et al., 2009) and adults with myocardial ischemia, trauma and stroke (Basu & Sharma, 2016; Jauch et al., 2013). Models of nursing surveillance suggest an inverse relationship with patient outcomes, meaning more and better surveillance results in less negative consequences whereas inadequate surveillance is associated with adverse events and failure to prevent or rescue patients from complications and harm (Kelly & Vincent, 2011; Shever, 2011; Kutney-Lee, Lake, & Aiken, 2009).

Though not empirically substantiated, a number of studies, in both pediatrics and adult populations, show that augmentation of nurse centric and organizational variables improves patient outcomes. In pediatric nursing settings these factors include experience, education, specialization, RN staffing models, permanent staff, higher nurse to patient ratios, lower patient acuity, academic settings and participation in national registries (Hickey, Gauvreau, Curley, & Connor, 2013; Krapohl, Manojlovich, Redman, & Zhang, 2010; Mark, Harless, & Berman, 2007; Profit et al., 2010; Tibby, Correa-West, Durward, Ferguson, Murdoch, 2004). Enhanced nursing surveillance is often proposed as a consequence of increases in precursor factors and a mediator of improved patient outcomes.

Experts suggest that to improve the early recognition and response to patient instability a multipronged approach is needed that focuses not only on enhanced monitoring capability and early warning mechanisms but also on cultural and system change (DeVita et al., 2010; Hayes et al., 2012; Kyriacos, 2011; McCurdy & Wood, 2012; McNeill & Bryden, 2013; Robb & Seddon, 2010; Shearer et al., 2012). Guidance for optimization of a comprehensive approach such as this

is likely to originate from multiple methods of scientific inquiry. A study methodology that focuses on the impact on the patient, family, practitioner, and environmental variables and their interaction would be beneficial to advancing our understanding of nursing surveillance.

The qualitative data gathered from this study will contribute to efforts aimed at advancing an understanding of how to improve early recognition and treatment of deterioration by nurses. Furthermore, the results of this research will provide empiric data for the basis of a theoretical explanation of nursing surveillance. This will provide a foundation for future research with aims to understand and prevent deterioration from failures in early assessment and management.

Research Aims

The overall goal of this grounded theory research study is to explore the experiences of pediatric nurses when faced with a deteriorating patient in a non ICU environment. The specific research question is what environmental, human, and interactional factors amplify or modify surveillance of deterioration in non ICU patients by pediatric nurses. The specific research aims include

- describe and analyze what nurses do in the process of recognizing and responding to patient deterioration;
- understand the facilitators and barriers to nursing surveillance and treatment actions prior to patient deterioration;
- explore and analyze the impact of social interactions between nurses, other clinicians, and family members on the impact surveillance quality;
- further define a theoretical construct of nursing surveillance.

Overview of Chapters Two through Five

Chapter two is an integrative review of the literature on facilitators and barriers to nursing surveillance of non ICU pediatric patients. It presents a synthesis of studies specifically aimed at describing actions associated with recognition and management of deterioration and factors that influence the quality of pediatric nursing surveillance. Findings are presented as facilitators and barriers within a sociotechnical framework of conditioning factors (inputs) and care delivery processes (throughputs). This paper has been submitted for publication, and has received a request for revisions, in the Journal of Pediatric Nursing.

Chapter three presents an interpretation of findings organized around a central viewpoint of *maintaining perspective on patient stability within a sociotechnical system* to explain how the context and conditions on acute pediatric nursing units influence actions of surveillance actions and their consequences. These findings extend and explain additional aspects of the model presented in chapter two.

Chapter four extends the model with findings that specifically address the social process of *role integration of the nurse and parents in patient surveillance*.

References

Basu, J., & Sharma, S. (2016). Early recognition vital in acute coronary syndrome. *Practitioner, 260*(1797), 19-23.

Berger, Z., Flickinger, T. E., Pfoh, E., Martinez, K. A., & Dy, S. M. (2014). Promoting engagement by patients and families to reduce adverse events in acute care settings: A systematic review. *BMJ Quality & Safety, 23*(7), 548-555. https://doi.org/10.1136/bmjqs-2012-001769

Brierley, J., Carcillo, J. A., Choong, K., Cornell, T., Decaen, A., Deymann, A., . . . Zuckerberg, A. (2009). Clinical practice parameters for hemodynamic support of pediatric and neonatal septic shock: 2007 update from the American College of Critical Care Medicine. *Critical Care Medicine, 37*(2), 666-688. https://doi.org/10.1097/CCM.0b013e31819323c6

Bulechek, G. M., Butcher, H.., Dochterman, J. M., & Wagner, C. M. (2013). *Nursing interventions classification (NIC;* 6th ed.) St. Louis, MO: Elsevier.

DeVita, M. A., Smith, G. A., Adam, S. K., Adams-Pizarro, I., Buist, M., Bellomo, R.,…Winters, B. (2010). Identifying the hospitalized patient in crisis – A consensus conference on the afferent limb of rapid response systems. *Resuscitation, 81*(4), 375-382. https://doi.org/10.1016/j.resuscitation.2009.12.008

Franklin, C., & Mathew J. (1994). Developing strategies to prevent in-hospital cardiac arrest: analyzing responses of physicians and nurses in the hours before the event. *Critical Care Medicine, 22*(2), 244-247.

Hanson, C. C. Randolph, G. D., Erickson, J. A., Mayer, C. M., Bruckel, J. T., Harris, B. D., & Willis, T. S. (2010). A reduction in cardiac arrests and duration of clinical instability after implementation of a paediatric rapid response system. *Postgraduate Medical Journal, 86*(1015), 314-318. https://doi.org/10.1136/qshc.2007.026054

Hayes, L. W., Dobyns, E. L., DiGiovine, B., Brown, A. M., Jacobson, S., Randall, K. H.,…Markovitz, B. (2012). A multicenter collaborative approach to reducing pediatric codes outside the ICU. *Pediatrics, 129*(3), e785-e791. https://doi.org/10.1542/peds.2011-0227

Hickey, P. A., Gauvreau, K., Curley, M. A., & Connor, J. A. (2013). The effect of critical care nursing and organizational characteristics on pediatric cardiac surgery mortality in the United States. *Journal of Nursing Administration, 43*(12), 637-644. https://doi.org/10.1097/NNA.0000000000000005

Jauch, E. C., Saver, J. L., Adams, H. P., Jr., Bruno, A., Connors, J. J., Demaerschalk, B. M.,…Yonas, H. (2013). Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals form the American Heart Association/American Stroke Association. *Stroke*, *44*(3), 870-947. https://doi.org/10.1161/STR.0b013e318284056a

Kelly, L., & Vincent, D. (2011). The dimensions of nursing surveillance: A conceptual analysis. *Journal of Advanced Nursing, 67*(3), 652-661. https://doi.org/10.1111/j.1365-2648.2010.05525.x

Kim, L., Lyder, C. H., McNeese-Smith, D., Leach, L. S., & Needleman, J. (2015). Defining attributes of patient safety through a concept analysis. *Journal of Advanced Nursing, 7*(11), 2490-2503. https://doi.org/10.1111/jan.12715

Krapohl, G., Manojlovich, M., Redman, R., & Zhang, L. (2010). Nursing specialty certification and nursing-sensitive patient outcomes in the intensive care unit. *American Journal of Critical Care, 19*(6), 490-498. https://doi.org/10.4037/ajcc2010406

Kutney-Lee, A., Lake, E .T., & Aiken, L .H. (2009). Development of the hospital nurse surveillance capacity profile. *Research in Nursing & Health, 32*(2), 217-228. https://doi.org/10.1002/nur.20316

Kyriascos, U. (2011). Monitoring vital signs using early warning scoring systems: A review of the literature. *Journal of Nursing Management, 19*(3), 311-330. https://doi.org/10.1111/j.1365-2834.2011.01246.x

Marek, K. M. (1992). Analysis of the relationship among nursing diagnoses and other selected patient factors, nursing interventions and other measures of utilization, and outcomes in health care (Doctoral dissertation). Retrieved from Dissertation Abstracts International. (UMI No. 9225208)

Mark, B. A., Harless, D. W., & Berman, W. F. (2007). Nursing staffing and adverse events in hospitalized children. *Policy, Politics, & Nursing Practice, 8*(2), 83-92. https://doi.org/10.1177/1527154407303499

Martin, K. S., Scheet, N., & Stegman, M. R. (1993). Home health clients: Characteristics, outcomes of care, and nursing interventions. *American Journal of Public Health, 83*(12), 1730-1734. https://10.2105/ajph.83.12.1730

Meyer, G. A., Lavin, M. A., Perry, A. G. (2007). Is it time for a new category of nursing diagnosis? *International Journal of Nursing Terminologies and Classifications, 18*(2), 45-50. https://doi.org/10.1111/j.1744-618x.2007.00049.x

McCurdy, M. T., & Wood, S. M. (2012). Rapid response systems: Identification and management of the "prearrest state". *Emergency Medicine Clinics of North America, 30*(1), 141-152. https://10.1016/j.emc.2011.09.012

McNeill, G., & Bryden, D. (2013). Do either early warning systems or emergency response teams improve hospital patient survival? A systematic review. *Resuscitation, 84*(12), 1652-1667. https://doi.org/10.1016/j.resuscitation.2013.08.006

Neff, D. F., Kinion, E. S., & Cardina, C. (2007). Nurse managed center: Access to primary health care for urban Native Americans. *Journal of Community Health Nursing, 24*(1), 19-30. https://doi.org/10.1080/07370010709336583

Profit, J., Petersen, L. A., McCormick, M. C., Escobar, G. J., Coleman-Phox, K., Zheng, Z., Pietz, K., Zupancic, J. A. (2010). Patient-nurse ratios and outcomes of moderately preterm infants. *Pediatrics, 125*(2), 320-326. https://doi.org/10.1542/peds.2008-3140

Pietz, K., Zupancic, J. A. (2010). Patient-nurse ratios and outcomes of moderately preterm infants. *Pediatrics, 125*(2), 320-326. https://doi.org/10.1542/peds.2008-3140

Reis, A. G., Nadkarni, V., Perondi, M. B., Grisi, S., & Berg, R. A. (2002). A prospective investigation into the epidemiology of in-hospital pediatric cardiopulmonary resuscitation using the international Utstein reporting style. *Pediatrics, 109*(2), 200-209. https://doi.org/ 10.1542/peds.109.2.200

Robb, G., & Seddon, M. (2010). A multi-faceted approach to the physiologically unstable patient. *Quality & Safety in Healthcare, 19*(5), e47-e47. https://doi.org/10.1136/qshc.2008.031807

Shearer, B., Marshall, S., Buist, M. D., Finnigan, M., Kitto, S., Hore, T.,…Ramsay, W. (2012). What stops hospital clinical staff from following protocols? An analysis of the incidence and factors behind the failure of bedside clinical staff to activate the rapid response system in a multi-campus Australian metropolitan healthcare service. *BMJ Quality & Safety, 21*(7), 569-575. https://doi.org/10.1136/bmjqs-2011-000692

Shever, L. L. (2011). The impact of nursing surveillance on failure to rescue. *Research and Theory for Nursing Practice: An International Journal, 25*(2), 107-126.

Shever, L .L., Titler, M., Dochterman, J., Fei, Q., & Picone, D. M. (2007). Patterns of nursing intervention use across 6 days of acute care hospitalization for three older patient populations. *International Journal of Nursing Terminologies and Classification, 18*(1), 18-29. https://doi.org/10.1111/j.1744-618X.2007.00044.x

Tibby, S. M., Correa-West, J., Durward, A., Ferguson, L., & Murdoch, I. A. (2004). Adverse events in a pediatric intensive care unit: relationship to workload, skill mix and staff supervision. *Intensive Care Medicine, 30*(6), 1160-1166. https://doi.org/ 10.1007/s00134-004-2256-y

Tume, L. (2007). The deterioration of children in ward areas in a specialist children's hospital. *Nursing in Critical Care, 12*(1), 12-19. https://doi.org/10.1111/j.1478-5153.2006.00195.x

CHAPTER TWO

NURSING SURVEILLANCE FOR DETERIORATION IN PEDIATRIC PATIENTS: AN INTEGRATIVE REVIEW[1]

JAMES R. STOTTS

[1] Manuscript submitted to *Journal of Pediatric Nursing*

Abstract

Problem

Adverse events occur in up to 19% of pediatric hospitalized patients, often associated with delays in recognition or treatment. While early detection is recognized as a primary determinant of recovery from deterioration, most research has focused on profiling patient risk and testing interventions, and less on factors that impact surveillance efficacy. This integrative review explored actions and factors that influence the quality of pediatric nursing surveillance.

Eligibility Criteria

Original research on nursing surveillance, escalation of care, or cardiopulmonary deterioration in hospitalized pediatric patients in non-critical environments, published in English in peer reviewed journals.

Sample

Twenty-four studies from a literature search within the databases of CINAHL, PubMed, and Web of Science were evaluated and synthesized using a socio-technical systems theory framework. Study quality was assessed using The Mixed Methods Appraisal Tool.

Results

Assessment, documentation, decision-making, intervening and communicating were identified as activities associated with surveillance of deterioration. Factors that influenced nurses' detection of deterioration were patient acuity, nurse education, experience, expertise and confidence, staffing, standardized assessment and communication tools, availability of emergency services, team composition and opportunities for multidisciplinary care planning.

Conclusions

Limited research provides insight into some aspects of nursing surveillance but does not explore factors that affect clinical data synthesis, decision making about surveillance intensity and management, and family impact on nursing surveillance.

Implications

Research is needed to enhance understanding of the contextual factors that impact nursing surveillance to inform intervention design to support nurses' timely recognition and mitigation of clinical deterioration.

Problem

Clinical deterioration is an unexpected, undesired experience for children who are admitted to the hospital. Physiologic deterioration is typically characterized as either an abrupt or gradual outcome of impaired or worsening vitality (Anderson, 2002; Stedman, 2012). Abrupt clinical deterioration is primarily measured as rates of adverse events such as failure to rescue (death following adverse events or complications of care), cardiopulmonary arrest, or in-hospital mortality (Bonafide, Roberts, et al., 2012). Institution of resuscitative treatments such as fluids or oxygen or transfer to a higher level of care have also been used as surrogate measures (Jones, Mitchell, Hillman, & Story, 2013). For children hospitalized in acute care settings, the rates of clinical deterioration vary from 2-19% (Berg, Nadkarni, Zuercher, & Berg, 2008; Tume, 2007). Up to 16% of clinical deterioration events can be attributed to suboptimal care such as delays in recognition or escalation (Hayes et al., 2012).

Recent studies have shown that surveillance efficacy and rescue outcomes are impacted by several individual and organizational factors: the availability of equipment, staffing, skill and team composition, interactions between people, and with technology (Azzopardi, Kinney, Moulden, & Tibballs, 2011; Brady & Goldenhar, 2014; Brady et al., 2013; Hayes et al., 2012; Joffe, Anton, & Burkholder, 2011). According to Benner (1984), essential aspects of nursing practice are to detect changes in patient condition, anticipate deterioration prior to confirming diagnostic signs, and assess the patient's response to treatment. Nursing surveillance is a continuous process of acquisition, interpretation, and synthesis of physical, behavorial, and cognitive patient data to determine intervention and threats to health and safety during the course of nursing care (Bulechek, Butcher, Dochterman, & Wagner, 2013; Kelly & Vincent, 2011 Meyer, Lavin, & Perry, 2007). Research in the sociotechnical aspects of nursing surveillance in

children's hospitals is sparse and has focused mostly on intensive care units (ICU; Hickey, Gauvreau, Curley, & Connor, 2013; Krapohl, Manojlovich, Redman, & Zhang, 2010). More research is needed to broaden our understanding of the contextual factors that affect nursing surveillance. Such research could inform the design of interventions that will support nurses' timely recognition and mitigation of clinical deterioration.

Aims

The purpose of this integrative review is to synthesize the findings of studies that examine factors that influence surveillance of deterioration by in-hospital pediatric nurses in non-ICU environments. Findings are analyzed along 4 specific lines of inquiry: 1) What do nurses do in the process of recognizing and responding to patient deterioration?, 2) What social interactions between nurses and other nurses, patients, families and other clinicians impact the quality of surveillance?, 3) What facilitates or hinders actions associated with nursing surveillance of unstable patients?, and 4) What gaps remain in our understanding of actions associated with nursing surveillance of pediatric patient deterioration?

Theoretical Framework

A socio-technical systems framework (Figure 1) by Karsh, Holden, Alper, and Or (2006) and the socioecological theory of child development and adaptation by Bronfenbrenner (1977) informed the search for factors associated with nursing surveillance and deterioration, guided inclusion and exclusion criteria, and framed the discussion of findings. In the socio-technical systems framework, health care delivery is described as several interacting social and technical processes (*throughputs*), shaped by family, patient, environment, and clinician characteristics or contributing factors (*inputs*) which influence clinical outcomes (*outputs*). In this model clinicians refers to all healthcare workers including nurses. Bronfenbrenner's socioecological

theory sensitized the search for studies that explain the effects of interactions and relationships between patients and family and the health care system on surveillance.

Method

Data Sources

A search of the CINAHL, PubMed, and Web of Science databases was conducted in January 2019 by JRS for English-language research published up to December 31, 2018 that was filtered for human and child, birth to 18 years. Searches were performed without restriction to year of publication, geography, race, or sex. Combinations of MeSH terms related to the recognition of clinical deterioration and failure to rescue were used but were not specific enough to narrow the search to pertinent studies. Thus several combinations of keywords were used as search terms (Table 1). A trained librarian and colleagues with extensive experience with qualitative research assisted the author in the derivation process. To complement the online search, the reference lists of relevant studies were also checked. Finally, targeted journals were searched from January 2005 to December 2018 for citations that may have been missed.

Inclusion/Exclusion Criteria

To be included in this review, studies had to (a) describe original research that was published in a peer-reviewed journal; (b) address any aspect of surveillance activities performed by nurses or contributing factors to nursing surveillance in noncritical care areas, as defined within the theoretical framework; and (c) report on at least one of the following outcomes: impact on surveillance, intensity, or escalation of care; transfer to a higher level of care; cardiopulmonary arrest; or death. Experimental and non-experimental studies were included to allow for a full review of nursing surveillance.

Search Outcome

The initial literature search yielded 1,289 articles. Following a review of their abstracts, 65 articles were read in full for relevancy. Based on the inclusion and exclusion criteria, 12 articles were selected for review. Twelve more articles, the yield of screening reference lists, were added for a total of 24 (Figure 2). Complete study characteristics can be found in (Table 2).

Quality Appraisal

The Mixed Methods Appraisal Tool (MMAT; Pluye et al., 2011) was used to evaluate the quality of research methods. This tool's criteria enables one to assess the quality of qualitative, quantitative, and mixed-methods studies with a score from 0-5 or 0, 25, 50, 75, and 100% based on how many of the tool's assessment criteria are met. Scores for mixed method research reflect an assessment of quality based on the lowest scoring methodology component. The MMAT's criteria have been found to have acceptable inter-rater reliability with interclass an correlation of 0.72 - 0.94 (Pace et al., 2012). No articles were excluded based on quality scores because each study's findings were consistent with general themes.

Results

Twenty-four articles, published from 2004-2008, met the selection criteria. Most were published after 2009. Thirteen studies were conducted in the United States (Akre et al., 2010; Bonafide et al., 2013; Brady & Goldenhar, 2014; Brady et al., 2015; Dudley & Carr, 2004; Kaul et al., 2014; Martin, Keller, Long, & Ryan-Wenger, 2016; Reese, Simmons, & Barnard, 2016; Roberts et al., 2014; Thrasher, McNeely, and Adrian, 2017; Voepel-Lewis, Pechlavanidis, Burke & Talsma, 2013; Watson, Skipper, Steury, Walsh, & Levin, 2014; Zenker et al., 2007), three in Canada (Lobos, Fernandes, Ramsay & McNally, 2014; Lobos, Fernandes, Williams, Ramsay & McNally, 2015; McGillis-Hall et al., 2010), three in the United Kingdom (Doman, Prowse, &

Webb, 2004; Oliver, Powell, Edwards & Mason, 2010; Theilen et al., 2013), two in Australia (Azzopardi, Kinney, Moulden, & Tibballs, 2011; McKay et al., 2013), two in Sweden (Almblad, Siltberg, Engvall, & Malqvist, 2018; Ygge & Arnetz, 2004), and one in Italy (Gawronski et al., 2018). Twenty-one studies were conducted in children's hospitals (Akre et al., 2010; Almblad et al., 2018; Azzopardi et al., 2011; Bonafide et al., 2013; Brady & Goldenhar, 2014; Brady et al., 2015; Gawronski et al., 2018; Kaul et al., 2014; Lobos et al., 2014; Lobos et al., 2015; Martin et al., 2016; McGillis-Hall et al., 2010; Oliver et al., 2010; Reese et al., 2016; Roberts et al., 2014; Theilen et al., 2013; Thrasher et al., 2017; Voepel-Lewis et al., 2013; Watson et al., 2014; Ygge & Arnetz, 2004; Zenker et al., 2007) two in pediatric units in a medical health system for adults and children (Dudley & Carr, 2004; McKay et al., 2013) and one in multiple centers (Doman et al., 2004). Two studies were performed within a larger study that was conducted at the same hospital (Bonafide et al., 2013; Roberts et al., 2014).

All of the studies reviewed used non-experimental designs. Twelve observational descriptive studies used cohort (Akre et al., 2010; Almblad et al., 2018; Lobos et al., 2014; Lobos et al., 2015; Martin et al., 2016; Oliver et al., 2010; Theilen et al., 2013) case-control (Brady et al., 2015; McKay et al., 2013; Voepel-Lewis et al., 2013; Zenker et al., 2007), or cross-sectional designs (Kaul et al., 2014;). Nine used qualitative designs: five used grounded theory (Bonafide et al., 2013; Brady & Goldenhar, 2014; Doman et al., 2004; Roberts et al., 2014; Ygge & Arnetz, 2004), three thematic analysis (Gawronski et al., 2018; Reese et al., 2016; Thrasher et al., 2017), and one ethnography (Dudley & Carr, 2004). Three studies used mixed methods with cohort or cross-sectional designs combined with thematic analysis of observations or open-ended responses to questionnaires (Azzopardi et al., 2011; McGillis-Hall et al., 2010; Watson et al., 2014).

Four studies addressed factors associated with pediatric nurse surveillance or facilitators and barriers to recognizing or managing clinical deterioration (Brady & Goldenhar, 2014; Gawronski et al., 2018; Thrasher et al., 2017; Voepel-Lewis et al., 2013). The remaining 20 studies, although not focused on nursing surveillance, reported findings that elucidate our understanding of the conditions or context of nursing surveillance of clinical deterioration. Six articles described outcomes associated with rapid response systems that are designed to assist non-ICU clinicians in identifying and managing clinically unstable patients (Azzopardi et al., 2011; Lobos et al., 2014; Lobos et al., 2015; Roberts et al., 2014; Zenker et al., 2007). Five articles described the effects of implementing a pediatric early warning scoring system (PEWS) on documentation, recognition, communication, and management of clinical deterioration (Akre et al., 2010; Almblad et al., 2018; Bonafide et al., 2013; Kaul et al., 2014; Oliver et al., 2010). Three studies described the experiences of parents in caring for their hospitalized child (Brady et al., 2015; Dudley & Carr, 2004; Ygge & Arnetz, 2004). Five papers described the effect of sociotechnical variables such as distractions within the clinical environment, equipment, teamwork, and staffing levels on facilitating or interfering with the ability of nurses to recognize clinical deterioration or make decisions about the clinical status of patients (Doman et al., 2004; McGillis-Hall et al., 2010; McKay et al., 2013; Reese et al., 2016; Watson et al., 2014). Finally, two studies described the impact of training on documentation, communication, or clinical response associated with managing instability (Martin et al., 2016; Theilen et al., 2013).

As outlined by Whittemore and Knafl (2005), the synthesis approach is used to critically analyze data. Concepts are categorized in a matrix format, as described by Webster & Watson (2002). Six themes associated with the aims of this research were derived through iterative and constant comparison.

Nursing Actions Associated with Surveillance and Management of Deterioration

Assessing and documenting.

Performing and documenting assessments were identified as important activities in recognizing patient deterioration and marshalling support for intervention. Knowledge of patients' baseline assessment, professional experience, and recognizing the early signs of clinical deterioration were acknowledged to be essential in deciding how and when to intervene (Azzopardi et al., 2011; Brady & Goldenhar, 2014; Gawronski et al, 2018; Kaul et al., 2014; McKay et al., 2013; Thrasher et al., 2017). Education about the indicators of deterioration, clinical experience, situation awareness, and use of a standard assessment tool such as the PEWS enhanced nurses' ability to evaluate instability (Azzopardi et al., 2011; Brady & Goldenhar, 2014; Bonafide et al., 2013; Kaul et al., 2014; Martin et. al, 2016; McKay et al., 2013; Theilen et al., 2013). Trusting one's intuition about abnormal assessments also aided identification of deterioration (Brady & Goldenhar, 2014; Doman et al., 2004; Gawronski et al., 2018).

Assessment documentation, in particular vital signs, followed by documentation of interventions were identified as indicators of instability awareness (Oliver et al., 2010; Theilen et al., 2013). Inadequate documentation or gaps in documentation were common (Akre et al., 2010; Almblad et al., 2018; Oliver et al., 2010; Watson, Skipper, Steury, Walsh, & Levin, 2014; Zenker et al., 2007). However, evidence suggests that nurses used objective and subjective assessment findings to evaluate instability (Zenker et al., 2007) and did not consistently document objective evidence of clinical deterioration or increased surveillance activities (Akre et al., 2010; Voepel-Lewis et al., 2013). Education about the importance of documentation and simulation training increased documentation (McKay et al., 2013; Theilen et al., 2013). Barriers to concurrent documentation of assessments and interventions included lack of computer

availability and functionality, excessive log-on times, and a preference not to enter information into medical records in front of patients and families (Watson et al., 2014).

Decision making.

Under specific conditions, nurses made decisions about monitoring intensity, how to intervene, and whether to call for help (Lobos et al., 2014; Lobos et al., 2015; Voepel-Lewis et al., 2013; Zenker et al., 2007). Surveillance intensity and escalating care increased when acuity of conditions was higher and staffing lower (Lobos et al., 2015; Voepel-Lewis et al., 2013). Standardized assessment tools with action algorithms facilitated data trending and decision making about monitoring and intervention (Akre et al., 2010; Almblad et al., 2018; Bonafide et al., 2013; Brady & Goldenhar, 2014; Gawronski et al., 2018; Kaul et al., 2014). Interruptions interfered with concentration and introduced competing priorities, which resulted in fragmented or delayed care (McGillis-Hall et al., 2010). Simulation training increased critical thinking skills, confidence, and competence in decision making and response times to recognition and intervention (Martin et al., 2015; Theilen et al., 2013).

Readily accessible resources such as a rapid response team (RRT) or medical emergency team (MET) and diverse and clinically competent staff provided assistance to the bedside clinician in determining course of treatment or the need to escalate care (Brady & Goldenhar, 2014; Gawronski et al., 2018; Lobos et al., 2014; McKay et al., 2013; Zenker et al., 2007). Deciding whether to call for help and who to call were influenced by hierarchical or cultural norms, nurses' self-confidence, fear of reprisal or criticism, physician bias not to escalate, clinician preference, and failure to recognize physiologic decline in patients who appeared to be asymptomatic (Azzopardi et al., 2011; Gawronski et al., 2018; Reese et al., 2016; Roberts et al., 2014; Thrasher et al., 2017). Nurses were more prone to activate the RRT or MET for surgical

patients because they perceived that surgeons were less available and less likely to address medical issues (Lobos et al., 2014).

Communicating changes in patient condition.

Domain et al. (2004) concluded that communicating changes in patients' conditions is an essential skill in caring for unstable patients. Nurses were more likely to report early changes in the status of patients following implementation of a RRT or MET, implementation of a PEWS, or an educational program on skills for managing deteriorating patients (Akre et al., 2010; Bonafide et al., 2013; Kaul et al., 2014; McKay et al., 2013; Theilen et al., 2013; Zenker et al., 2007). The PEWS provided a common language and objective criteria for communicating changes in the condition of patients (Brady & Goldenhar, 2014; Kaul et al., 2014; Oliver et al., 2010). Being assertive and having self-confidence and strong beliefs of self-efficacy empowered nurses to overcome perceived hierarchical barriers to communication (Azzopardi et al., 2011; Brady & Goldenhar, 2014; Doman et al., 2004; Roberts et al., 2014; Thrasher et al., 2017). Abrupt or discourteous communication and lack of face-to-face interaction resulted in curtailed communication (Reese et al., 2016). A sense of trust and safety between team members, a culture of accountability, access to expert resources, and structured opportunities for care planning supported collaboration, contingency planning, and seeking second opinions (Brady & Goldenhar, 2014: Doman et al., 2004; Reese et al., 2016; Roberts et al., 2014).

Intervening.

Nursing intervention for instability included more frequent assessments or adding some method of electronic surveillance (Akre et al, 2010). The PEWS and parental concern prompted increased surveillance and consultation with other clinicians or activating the RRT (Bonafide et al., 2013; McKay et al., 2013; Kaul et al., 2014; Gawronski et al., 2018). Increased assessments

and consultations occurred following intense simulated practice (Theilen et al., 2013). Nurses identified lack of knowledge or skills, loss of situation awareness, misinterpretation of cues, lack of confidence, lack of functioning equipment, interruptions, staffing shortages, and competing priorities as obstacles to mitigate clinical deterioration and precursors of suboptimal care (Brady & Goldenhar, 2014; McGillis-Hall et al., 2010; Thrasher et al., 2017).

Social Interactions affecting Surveillance

Relationships between team members.

A culture and environment that fosters teamwork, communication, accountability and safety were noted to improve situation awareness of clinical deterioration and recognition of patient risk (Brady & Goldenhar, 2014). Researchers identified support from leadership such as availability of strong clinical resources, established escalation protocols, and processes for multidisciplinary communication as a conditional factor for optimizing team communication, developing trust among clinicians, and empowering nurses to call emergency response teams (Gawronski et al., 2018; Thrasher et al., 2017). Standardized assessment and intervention tools provided a common language for describing and evaluating clinical deterioration. Opportunities for interprofessional care planning facilitated team cohesiveness on shared goals and contingency plans (Almblad et al., 2018; Bonafide et al., 2013; Brady & Goldenhar, 2014; Doman et al., 2004; Kaul et al., 2014; McKay et al., 2013).

Physician perceptions of the risks and benefits of calling the MET or transferring patients to the pediatric intensive care unit (PICU) mitigated escalation of care by nurses (Azzopardi et al., 2011; Roberts et al., 2014). Nurses and physicians reported that they were told not to call the MET (Azzopardi et al., 2011), a perception that they might lose control over clinical decision making (Roberts et al., 2014).

Hierarchical differences and norms influenced nurses' responses to clinical deterioration. In two studies, nurses said that they would call the attending physician before calling a MET (Azzopardi et al., 2011; Thrasher et al., 2017). Deferring to the attending physician was seen as maintaining relationships among team members (Roberts et al., 2014).

Nurses attributed delays in escalating care to a lack of ICU beds, having to convince physicians that treatment was urgent, or feeling the pressure of physicians to manage patients before calling for emergency assistance (Doman et al., 2004; Roberts et al., 2014; Thrasher et al., 2017). Researchers noted that nurses and physicians feared reprisal and criticism by colleagues for escalating care (Azzopardi et al., 2011; Brady & Goldenhar, 2014; Reese et al., 2016; Roberts et al., 2014; Roberts et al., 2014). Nurses solicited opinions from others or teamed with more senior nurses to advocate for intervention; this strategy helped them to overcome hierarchical barriers and avoid criticism about escalating care (Azzopardi et al., 2011; Roberts et al, 2014).

Parents as partners in surveillance.

Physicians, nurses, and parents reported that parent involvement helped identify concerning changes in a child's condition during hospitalization (Brady & Goldenhar, 2014; Gawronski et al., 2018). Nurses relied on parents to provide baseline characteristics of their child, identify when changes occurred, and summon emergency medical assistance when concerned about their child's condition or communication breakdowns (Brady et al., 2015; Gawronski et al., 2018; Zenker et al., 2007). Listening to and engaging parents in their child's care was perceived to enable situation awareness of patient risk and parent empowerment (Brady & Goldenhar, 2014; Gawronski et al., 2018). Parents expressed the need to be at the bedside to assure continuity of care, individualize attention, and monitor omissions in care (Dudley & Carr, 2004; Ygge & Arnetz, 2004). Parents reported that they were provided opportunities (a) to be

updated, (b) to partner in their child's care routines and treatment decisions, and to listen to concerns as supportive strategies that foster parental engagement and improve care delivery (Brady & Goldenhar, 2014; Dudley & Carr, 2004; Gawronski et al., 2018; Ygge & Arnetz, 2004). Parents believed that clinician work pressure, competing priorities, staffing shortages, and discontinuous care providers are obstacles to safety and quality of care (Dudley & Carr, 2004; Gawronski et al., 2018; Ygge & Arnetz, 2004).

Facilitators and Barriers to Surveillance of Unstable Patients

Several factors facilitate or interfere with nurses' ability to recognize or intervene when clinical deterioration occurs (Table 2). Conditions and processes that support nursing surveillance are environments rich with adequate staffing, tools for identifying and treating unstable patients, confident nurses and physicians with pediatric experience and training, protocols for communication and escalation, opportunities for collaborative decision making, and a culture that fosters collegial respect, teamwork, and family involvement.

Discussion

In a sociotechnical model of health care, care delivery is conceptualized as interactive care delivery activities or processes (care planning and surveillance) that are influenced by system factors such as clinician characteristics and unit-level resources. The variables identified in this review that impact nursing surveillance coalesce around nursing assessment, documentation, decision making, intervention, communication, and social interactions between nurses, physicians, and parents.

Current literature affirms the importance of assessment and variables that support assessment interpretation and synthesis (Azzopardi et al., 2011; Brady & Goldenhar, 2014; Gawronski et al, 2018; Kaul et al., 2014; McKay et al., 2013; Thrasher et al., 2017). Education

about the indicators of clinical deterioration and implementation of the PEWS increased observations (Kaul et al., 2013; Theilen et al., 2013). Situation awareness, intuition, and nurses' clinical knowledge and experience enhanced their ability to interpret assessment findings (Brady & Goldenhar, 2014; Domain et al., 2004; Gawronski et al., 2018). Simulation and the use of the PEWS improved nurses' ability to recognize and evaluate instability (Kaul et al., 2014; Martin et al., 2016). How nurses assess for clinical deterioration in pediatric patients has yet to be described. Nurses in other practice venues identify changes through sensory data; objective findings; intuitive feelings based on knowledge of their patients; patients' physical, cognitive, and behavioral changes from baseline; nurses' knowledge of usual condition patterns and illness trajectory; and input from medical records, handoff reports, and parents (Andrews & Waterman, 2005; Coiffi, 2000; Minick & Harvey, 2003). How these indices of deterioration are used in pediatric nursing surveillance are areas for further study.

The lack of documentation of nurse and physician activities in the hours before patients experience acute physiological deterioration is a common finding in retrospective reviews and is interpreted as a failure to rescue (Endacott, Kidd, Chaboyer, & Edington, 2007; Goldhill et al., 1999; Hayes et al., 2012; McQuillan et al., 1998; National Patient Safety Agency, 2007; Oliver et al., 2010; Tume, 2007). This review found evidence of context variables for delays in entering information into medical records other than performance failures. Zenker et al. (2007) found that nurses used objective and subjective assessments to evaluate instability, which was not documented in patients' medical records. Other reasons for absent or delayed documentation included user/interface limitations of electronic health record systems and preferences to not enter information into medical records concurrently or in front of patients (Watson et al., 2014; Zenker et al., 2007). A more thorough understanding of the impact of the electronic medical

record on maintaining situation awareness of clinical deterioration is an opportunity for further research.

Decision-making was contextual and centered primarily on choosing how and when to increase surveillance, initiate an intervention, or escalate care (Lobos et al., 2014; Lobos et al., 2015; Voepel-Lewis et al., 2013; Zenker et al., 2007). Brady and Goldenhar's (2014) argument that situation awareness is a key element for making decisions is supported by simulation literature where failures in communication, knowledge deficits, and loss of situation awareness were contributing factors to pediatric clinicians making suboptimal treatment decisions (O'Leary et al., 2014).

Several other factors including uncertainty, input from experienced nurses and physicians, and time pressure influence clinical decision making in other practice settings (Cranley, Doran, Tourangeau, Kushniruk, & Nagel, 2009; Thompson et al., 2008). Areas for further study include how heuristics, time pressure, decision making tendencies, organizational resources, team skills, familiarity with patients, interpersonal dynamics, and communication patterns influence decision making about surveillance activities and interventions in the pediatric setting.

Nurses intervened primarily by increasing surveillance or calling for help, usually by activating the emergency response team (Akre et al, 2010; Bonafide et al., 2013; McKay et al., 2013; Kaul et al., 2014; Gawronski et al., 2018; Theilen et al., 2013). In the studies reviewed, pediatric nurses relied on the RRT or MET to initiate interventions that are typically within the purview of acute care nurses to perform or coordinate by either protocol, scope of practice, or physician order; such interventions include the administration of oxygen, physiotherapy, obtaining venous access, suctioning, applying electronic monitoring, and obtaining laboratory

specimens (Akre et al., 2010, Lobos et al., 2014; Lobos et al., 2015). No study described specific actions, facilitators, or barriers to interventions by pediatric nurses when interacting with deteriorating patients. More research is warranted to identify what interventions acute care pediatric nurses initiate in the hours before clinical deterioration and the factors that inhibit or support action. This information would provide a basis for developing practice standards to facilitate earlier intervention.

Organizational structures such as a RRT, PEWS, routine opportunities for joint care planning, strong team function, individual communication skills, and self-confidence enhanced interprofessional communication (Brady & Goldenhar, 2014; Gawronski et al., 2018). Timely and effective escalation of care is facilitated by communication training, clear escalation protocols, the availability of senior clinicians, innovative communication technology to distribute tasks and control workflow, and a no-blame culture that encourages escalation as an expectation (Almblad et al., 2018; Brady, & Goldenhar, 2014; Reese et al., 2016; Thrasher et al., 2017). Other studies suggest that nurses' skills in asserting their concerns such as presenting cases for intervention or escalation; working within a team; and willingness to take risks also affects the efficacy of the clinical team in responding to clinical deterioration (Andrews & Waterman, 2005; Endacott & Westley, 2006; Gazarian, Henneman, & Chandler, 2010; Minick & Harvey, 2003). How these characteristics influence when and how pediatric nurses communicate concerns merits further study.

Interactions between clinical teams affected escalation of care and intervention for clinical deterioration (Bonafide et al., 2013; Brady & Goldenhar, 2014). Style and mode of communication influenced the efficacy of closed-loop interaction and collaboration

(Reese et al., 2016). Cultural norms, deference to rank and treatment preferences, and fears of reprisal and criticism stifled raising concerns or initiating interventions (Azzopardi et al., 2011; Thrasher et al., 2017). Similar findings of censored action are described in other clinical settings (Benin, Borgstrom, Jenq, Roumanis, & Horwitz, 2012; Lyndon, 2008; Sutcliffe, Lewton, & Rosenthal, 2004). Standardized communication and treatment tools along with opportunities to engage in shared care planning were perceived as cultural elements that fostered teamwork among clinicians (Bonafide et al., 20013; Brady & Goldenhar, 20014).

Integrating teamwork principles in the PICU, pediatric emergency department, and in simulated pediatric resuscitation exercises improved knowledge, attitudes, confidence, and team performance (Bultras, Hassler, Ercole, & Rea, 2014; Messmer, 2008; Patterson, Geis, LeMaster, & Wears, 2013; Thomas et al., 2007; Weinstock et al., 2005). Similar results occurred with simulation training and teams assembled for emergency care in other clinical venues (Gilfoyle et al., 2017; Reynolds, Ayres-de-Campos & Lobo, 2011). Team recognition and performance in the management of clinical deterioration in acute care pediatric settings requires further study. Such research should explore strategies to improve ad hoc team functioning in non-ICU environments, including the role of ancillary clinicians such as respiratory therapists and pharmacists, and how team training can improve mutual support, performance, and team orientation for unit-based clinical teams.

In models that conceptualize nursing surveillance management support is presented as a mitigating factor (Kelly & Vincent, 2011; Kutney-Lee, Lake, & Aiken, 2009). The publications in this review exemplify clinical and administrative activities that impact nursing surveillance. These include implementing processes that promote early recognition of deterioration,

interprofessional communication, and teamwork between nurses and physicians with managing changes in patient condition.

Collaboration between clinicians and parents was found to be essential in optimizing patient surveillance (Dudley & Carr; 2004; Gawronski et al., 2018). Parents provide baseline information, participate in care, and report condition changes (Dudley & Carr, 2004; Ygge & Arnetz, 2004; Paciotti et al., 2014). The experiences of, and interactions with, parents during the hospitalization of children has been studied from many perspectives (Power, N., & Franck, L., 2008). The presence of parents or a caregiver during hospitalization is critically important, and its contribution to the initial and on-going assessment of a child's response to illness has been well-established (Balling & McCubbin, 2001; Eckle & MacLean, 2001; Kristensson-Hallstrom & Elander, 1997; Paciotti, 2014; Thompson, 1986). However, the efficacy of family involvement in recognizing clinical deterioration, and the process of integrating nursing and parent roles in surveillance have not been fully studied. Anecdotal and quality improvement evidence supports the value of parents as surveillance agents in pediatric and adult patients (Baird & Turbin, 2011; Bogert, Ferrell, & Rutledge, 2010; Brady et al., 2015; Hueckel, Mericle, Frush, Martin, & Champagne, 2012; King, 2006). Although parents do recognize clinically significant changes, as reports suggest, their concerns were dismissed, overlooked, or inadequately evaluated in some situations (Bogert, Ferrell, Rutledge, 2010; Brady et al., 2015; Dunning et al., 2010; Greenhouse, Kuzminsky, Martin, & Merryman, 2006; Zenker et al., 2007). Other researchers have described how parents and nurses interact within the context of care for pediatric patients with acute and chronic conditions (Balling & McCubbin, 2001; Coyne & Cowley, 2007; Diehl, Moffitt, & Wade, 1991), but none have explored the factors that influence collaboration between families and nurses in detecting and acting on clinical deterioration.

Limitations

The objective of this integrative review was to describe what is known about nursing surveillance of clinical deterioration in pediatric patients. However, only four studies were found to share this specific aim. Accordingly, the review was broadened to include studies whose secondary aims or incidental outcomes were related to the aim of this review. Thus, the analysis was based on direct and indirect evidence.

Only studies published in English were reviewed. The literature search was based on word combinations from the quality and safety literature because the yield using standard MeSH terms was nonspecific and limited. As such, relevant studies may have been missed because of inexact word sequencing or grouping or subjective citation bias.

Despite these limitations, this is the first review to our knowledge that addresses the factors that influence how well non-ICU pediatric nurses surveil clinical deterioration in hospitalized children. The methodology to locate relevant research was comprehensive and yielded findings that more fully developed existing surveillance theoretical models.

Clinical and Research Implications

This review proposes a new model that combines aspects of socio-technical and socioecological theories with current definitions of nursing surveillance. Also presented is a novel accounting of conditional or input factors and well as care delivery or throughput processes that facilitate or impede nursing surveillance. These two additions propose advances to current theoretical models of nursing surveillance, as well as provide a basis for future research and program development to improve nursing surveillance. Clearly, there is more to learn about the facilitators and barriers to interpretation, synthesis, analysis, and decision making when it comes to surveillance intensity and when or how to intervene. Education and

standardized tools facilitate assessment and documentation. Not known is how other data sources such as handoff reports, medical records, family, sensory cues, or intuition influence surveillance or prompt intervention. The studies in this review elucidate the actions nurses have taken when patients experience changes in their condition, although the full range of interventions have not been described.

Some research has endorsed the benefits of parent engagement in surveillance, but the evidence is insufficient to inform its effective implementation (Berger, Flickinger, Pfoh, Martinez & Dy, 2014). Studies have focused on how nurses and parents define and negotiate their 'partnership' in providing care (Espezel & Canam, 2003; Coyne & Cowley, 2007), but not specifically on the collaboration between parents and nurses in the surveillance of hospitalized children. Research that provided a greater understanding of how to integrate the roles of parents and nurses in surveillance would assist to enhance hospital based patient safety and patient experience programs.

How pediatric nurses decide what interventions should be initiated for unstable patients has yet to be explored. The high-stakes, time-dependent, and uncertain conditions of clinical deterioration seem to favor an intuitive-humanistic, information-processing strategy. What environmental or cultural factors support this decision-making process for pediatric nurses with varying characteristics are unknown.

Initiatives to improve resuscitation efforts may well use the findings of this review to improve socio-technical aspects in clinical environments, including the accessibility of equipment for monitoring and treatment and using staffing models that emphasize patient continuity, assignment flexibility, and availability of clinical expertise to increase staff resilience in handling clinical instability. Incorporating standardized assessment methods such as the

PEWS and treatment guidelines, parent engagement in surveillance, simulation training, and opportunities for contingency planning are strategies that may increase recognition, situation awareness, shared mental models, decision making, and escalation. Finally, cultivating teamwork through structured communication, communication training, and opportunities for interprofessional care planning may increase confidence and assertion of concerns and escalation and reduce hierarchal barriers and missed opportunities to mitigate harm.

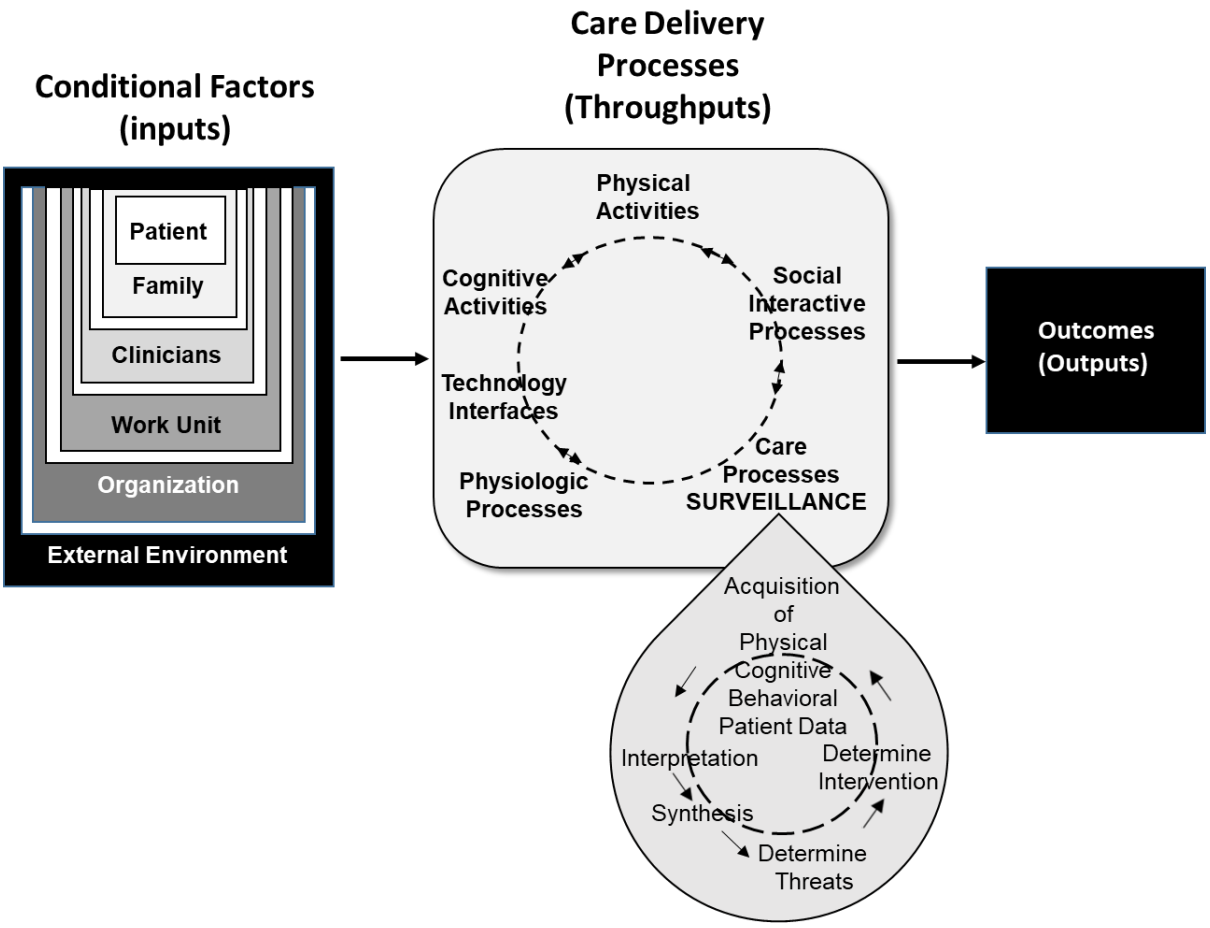

Figure: 2.1
Model of Surveillance

Note: Model is depicted in a socio-technical system framework. The family, patient, clinician, work unit, organization and external environment are conditional factors (inputs) which influence how care is delivered. Care delivery (throughputs) is comprised of activities and interactions of and between people, the enviroment, and technology. Surveillance is a mechanism of care processes that involves acquistion, interpretation and synthesis of patient data and determining threats to health and safety and course of action. Adapted from "A human factors engineering paradigm for patient safety: Designing to support the performance of the healthcare professional," by B. T. Karsh, R. J. Holden, S. J. Alper, and C.K. Or, 2006, *Quality and Safety in Health Care, 15,* i61.

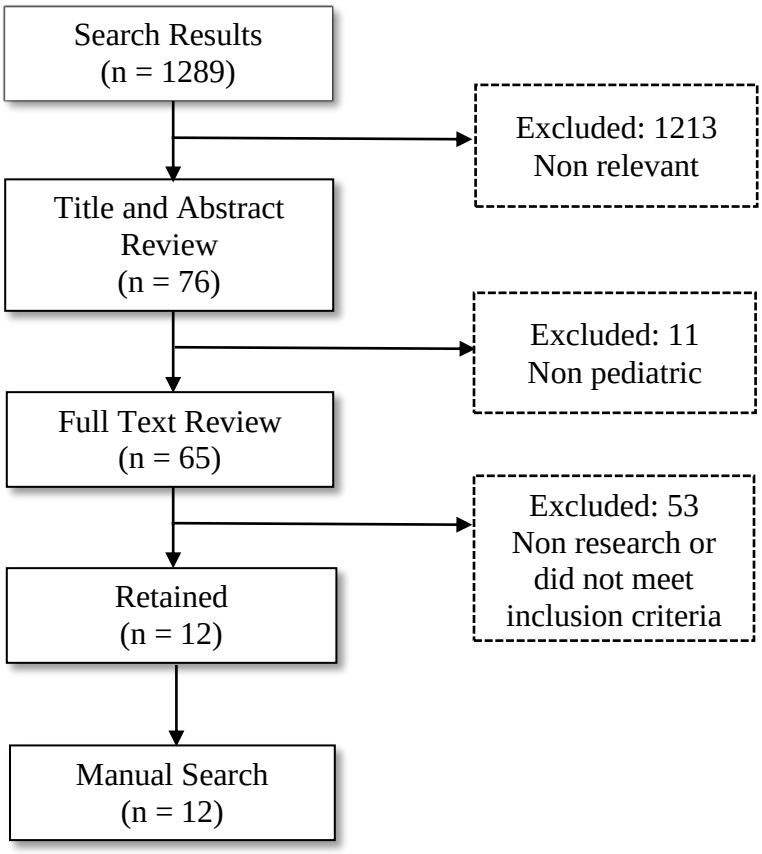

Figure 2.2
Search Strategy

Table 2.1

Search Terms and Keyword Combinations

Search Terms and Combinations
Nursing AND surveillance
Add Pediatric
Nursing surveillance AND Deterioration
Add Pediatric
Nursing surveillance and Pediatric and Deterioration
Nursing observations
Add Pediatric
Nursing Observation Critical
Nursing Observation Cardiopulmonary Arrest
Add Pediatric
Detection AND Deterioration
Add Pediatric
Detection Deterioration Cardiac
Recognition AND Deterioration
Add Pediatric
Nursing Recognition Emergency
Add Pediatric
Early Recognition of deteriorating patients
Add Pediatric
Surveillance and Deterioration
Add Pediatric
Surveillance or monitor
Add adverse events or deterioration or inpatients and/or hospitalization
Critical illness/nursing AND Deterioration AND Pediatric
Nurses AND Decision Making AND Pediatric
Hospital rapid response team AND Pediatric AND Nursing Surveillance
Hospital rapid response AND Pediatric and Nursing Care
Hospitals, Pediatric
Add infant or child or adolescent
Pediatric AND Nursing records AND Quality of health care
Communication Barriers
Add rapid response or emergency or deterioration or deterioration Schema
Rapid response
Add delay
Prevention or recognition or monitoring
Add deterioration or emergency
Serious Safety Event
Add prevention or recognition or monitoring
Situation awareness
Recognition
Add deterioration
Barriers
Add recognition or deterioration or clinical deterioration
Awareness
Add Patient Safety and/or inpatients or hospitalization or Hospitals, Pediatric or Patient Harm/prevention and control
Patient harm/prevention and control

Note: Filters: English, Human, Child: birth-18 years

Table 2.2

Summary of Studies about Factors Associated with Nursing Surveillance of Pediatric Patients

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Akre et al., 2010 (USA)	Evaluate outcomes of PEWS and examine staff awareness of deterioration.	Med/surg units of 325 bed freestanding Children's Hospital 186 RRT/ code blue events	Retrospective descriptive cohort study using chart review by critical care nurses Staff awareness measured as increased surveillance or intervention.	▪ Higher PEWS associated with earlier escalation, increased consultations, added monitoring, increased nursing documentation ▪ Subset analysis showed elevated PEWS hours prior to intervention or documentation	75%
Almblad et al., 2018 (Sweden)	Describe PEWS data entry and examine adherence to PEWS clinical guidelines related to work context.	3 clinical units at a freestanding Children's Hospital, 875 charts reviewed of patients < 19 years	Retrospective descriptive cohort study comparing clinical unit results of random sample chart review post Early Detection and Treatment program for RNs and NAs Alberta Context survey tool used to assess differences in work context	▪ Adherence to PEWS guidelines (assessments and intervention) varied between units; highest for oxygen saturation with respiratory distress and on admission; lowest for assessments of BP and pain ▪ Documentation of recommended actions was incomplete. ▪ No differences in work context except for leadership qualities	75%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Azzopardi et al., 2011 (Australia)	Assess value of and barriers to MET activation.	250 bed freestanding Children's Hospital 280 RNs, 127 MDs	Mixed methods, descriptive cohort study using survey tool and thematic analysis of open ended questions. Participants coded as callers of MET or responders	▪ Response rate 24.1% ▪ MET valued for support & intervention ▪ Clinicians disagreed that MET deskilled ▪ MD callers/RN responders felt MET overused ▪ Delays in MET calls d/t initial escalation to Attending or PICU, unrecognized deterioration, fear of or actual criticism, instruction not to, patient appearing well ▪ 50% participants call for concern	25%
Bonafide et al., 2013 (USA)	To identify mechanisms by which physicians and nurses use PEWS to support decision making.	504 bed freestanding Children's Hospital 27 RNs, 30 MDs caring for child ≤ 18 yrs on general medical or surgical ward with false -/+ PEWS	Grounded theory Semi-structured interviews	▪ PEWS facilitated recognition, surveillance, intervention, and communication of concern except with stable, baseline abnormal, or neurologic instable patients.	75%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Brady & Goldenhar, 2014 (USA)	Learn about factors that influence SA and identification, mitigation and escalation of patient risk.	523 bed freestanding Children's Hospital 31 participants (10 charge nurses, 8 bedside nurses, 3 respiratory therapists, 10 residents)	Grounded theory Semi-structured interviews with focus groups assigned by role	*Themes for improved SA* ▪ Team based care resulting in empowered families and nurses, and culture of teamwork, accountability & safety ▪ Standardization of training, risk identification, intervention, communication, and staffing ▪ Increased clinical experience, and opportunities for care continuity planning	75%
Brady et al., 2015 (USA)	To understand why families call MET, burden of family-activated MET calls, and all MET call outcomes.	577 bed freestanding Children's Hospital 40 family-activated MET calls, 1156 clinician MET calls	Retrospective cohort study using nested case-control method using structured chart review as part of a quality improvement project. Data from both sample sets were stratified by nursing unit and month of call.	▪ 23% family vs. 60% clinician calls resulted in transfer to ICU; 77% vs 40% remained on floor ▪ Reason for activation similar between groups with clinical deterioration most prevalent ▪ Unique family triggers were lack of response and dismissive interaction	50%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Doman et al., 2004 (United Kingdom)	Explore experiences and issues of nurses providing high dependency care in children's wards.	Multiple sites of children wards and hospitals 12 pediatric nurses	Qualitative study using focus group interviews	▪ Over reliance on equipment/ monitors ▪ Good assessment/ observational skills, adequate skill, training/education, experience, ability to communicate with MD, being assertive, confidence, use of instinct/gut feelings essential for recognizing deterioration ▪ Teamwork, MD trust in RN judgement, leadership/ management, and adequate staffing are important cultural characteristics	75%
Dudley & Carr, 2004 (USA)	To explore the phenomenon of vigilance of parents staying at the bedside with a hospitalized child.	34 bed general pediatric unit in teaching hospital 10 parents of children aged 5-18 hospitalized for at least 48 hrs without a terminal illness	Ethnographic study Semi-structured interview Participant observation	5 themes describing vigilance: ▪ *Commitment to care:* parents feeling responsible to advocate, be involved, and watch over child ▪ *Resilience:* perseverance, hope and self-care ▪ *Emotional upheaval:* constant worry, uncertainty, loss of control, life & death decisions ▪ *Dynamic relationships* between relatives and with staff ▪ *Transition:* change in comfort, space, daily life pattern	100%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Gawronski et al., 2018 (Italy)	To identify factors influencing escalation of care in deteriorating children.	607 bed freestanding Children's Hospital 23 clinicians with pediatric clinical experience with deterioration in last 12 months from 9 clinical areas 9 parents from non-ICU	Qualitative study with thematic analysis Focus groups with semi-structured interview guide using scripts of clinical deterioration. Parents asked to recall child's hospital experience and describe response of staff. Focus groups assigned by role (staff nurses, nurse managers, ward physicians, PICU physicians, and parents).	4 facilitator/barrier themes: ▪ Skill, experience, knowledge impacts: confidence, credibility, parent comfort, need for consultation ▪ Relationships and leadership impacts: hierarchy, empowerment, partnership, communication, teamwork ▪ Recognition & Rx supported by experience & intuition, monitoring, rounding, standard observation, critical thinking, situation awareness, empowerment ▪ Organizational factors: staffing, workload, competing demands, continuity of care, patient pathways	100%
Kaul et al., 2014 (USA)	Determine impact of PEWS tool on RNs' ability to recognize and manage deterioration, communicate assessments, and MD and RN perception of RN abilities.	2 acute care medical units in a 300 bed freestanding Children's Hospital 35 RNs and 17 MDs	Descriptive, cross-sectional study using study and control group Study unit received training on PEWS & care recommendations while control unit did not. Separate RN and MD survey tools used to evaluate RN outcomes	▪ Study unit RNs reported greater ability to recognize deterioration and escalate care ▪ Study unit MDs reported study unit RNs more better at communicating deterioration concerns ▪ Differences between RN and MD groups with assessment parameters used to determine stability and answers to scenario questions	75%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Lobos et al., 2014 (Canada)	Describe patient characteristics, MET activation, MET interventions, and patient disposition by type of health care staff activating MET.	166 bed freestanding Children's Hospital 800 MET activations of patients < 18 yrs	Retrospective descriptive cohort study Chart review & outcome variables (PICU admission, # interventions, type of interventions) abstracted from MET data base	▪ *MET activators:* 53.3% MDs, 47.7% RNs; no difference in call indications ▪ RN activations were mostly in medical patients, more likely when being followed by MET, following surgery, resulted in less PICU admits, more sedative use ▪ Multiple activations associated with higher PICU admission rates, respiratory issues, prior activation ▪ Similar # and type of interventions between groups (those requiring MD order and those under RN control)	75%
Lobos et al., 2015 (Canada)	Investigate follow-up activities of MET team and associations between patient variables and intervention or additional MET visits following PICU discharge.	166 bed freestanding Children's Hospital 1805 patients 18 yrs and younger; 4841 MET follow-up visits	Retrospective , descriptive, cohort study Demographic, process, and outcome data abstracted from chart review and MET database	▪ Major MET interventions associated with patients with multiple diseases, surgery within last 7 days, unscheduled visit, intervention at first follow-up visit ▪ 11 patients readmitted to PICU at time of MET planned visit ▪ 64 patients required unplanned MET to evaluate patient ▪ 230 patients received intervention (those requiring MD order and those under RN control) by MET during follow-up visit, with physiotherapy and suctioning most common.	75%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Martin et al., 2016 (USA)	To evaluate effect of simulation on RN clinical judgment and performance with deterioration, and patient outcomes. To evaluate relationships between judgment accuracy and RN characteristics.	527 bed, freestanding Children's Hospital 83 RNs on general medicine unit	Pre/post observational, descriptive study following 5 simulation experiences. Health Science Reasoning Test Medical Education Technologies Incorporated Simulation Effectiveness Tool Confidence/ competence self-evaluation tool Chart audit	▪ # of simulations increased confidence & critical thinking but not PEWS accuracy. ▪ PEWS PICU transfer rates ▪ PEWS accuracy was not effected by age, self-appraised confidence or competence, degree, yrs of experience, or full time equivalents hired to work, but increased on day shift and with experiences with code/Assessment Consult Transfer events. ▪ PICU admission not effected by RN demographics or confidence/competence self-appraisal.	50%
McGillis-Hall et al., 2010 (Canada)	To investigate the context of interruptions in work with nurses in pediatric acute care units.	4 units in a 400 bed freestanding Children's Hospital 32 nurses 9 nurses randomly selected to participate in focus group	Descriptive mixed method study with thematic analysis. *1st phase* cross-sectional observation *2nd phase* thematic analysis	▪ Sources of distraction: environment, people with RNs being the greatest percent. ▪ Types of distractions: unexpected encounters, managing discrepancies. ▪ Primary causes: communication about patient care, equipment, need for assistance. ▪ Distractions impacted completion of work, concentration, having to multitask ▪ Some distractions perceived as increasing safety and improving care.	75%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
McKay et al., 2013 (Australia)	To evaluate impact of multifaceted intervention on vital sign documentation, interprofessional communication & medical review in deteriorating pediatric patients.	2 pediatric wards at tertiary hospital Random selection of patients admitted pre (262) and post (221) study periods	Prospective controlled pre/post intervention trial Chart review Pre/post intervention survey to assess knowledge of signs of deterioration, confidence in assessing	▪ Significant improvement in documentation of assessment data and communication between RN & MD ▪ Reduced time for escalation and for medical reviews ▪ Reduction in the unexpected transfers to higher level of care ▪ Improved compliance with MET criteria ▪ No significant changes in unexpected deaths, hospital length of stay, or # of MET calls ▪ Nonsignificant improvement in knowledge or confidence in assessing.	100%
Oliver et al., 2010 (Wales)	To determine the feasibility of implementation of a PEWS and assess compliance with recording vital assessments during PEWS implementation.	freestanding Children's Hospital 1000 non ICU or high dependency unit patients aged 0-16 yrs without cardiac/ respiratory arrest 9,075 sets of PEW data	Observational study during prospective, observational cohort study Retrospective chart review/ audit for frequency of PEW parameter recording.	Compliance with vital assessment recordings: ▪ T – 88.4% ▪ HR – 86.8% ▪ RR – 79.7% ▪ Sp02 – 76.7% ▪ BP – 58% ▪ AVPU – 36% ▪ Clinician worried – 20.7% ▪ Airway threat – 8.1% Variations in compliance attributed to medical consultant preference, reluctance to disturb children with equipment for BP and SpO2, lack of specificity to frequency of routine observations	50%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Reese et al., 2016 (USA)	To understand facilitators and barriers effecting assertion communication of concerns among nurses and physicians on an inpatient pediatric medical unit.	freestanding 373 bed Children's Hospital 11 RNs 16 MDs in pediatric rotation 9 Attendings,	Qualitative study – thematic analysis Focus groups for each clinician type using semi-structured interviews using tool based on literature.	*Interpersonal factors* ▪ Fears related to hierarchy: reluctance to assert d/t fear of appearing incompetent, go above someone, not being heard r/t position ▪ Prior encounters/ relationships ▪ Closed personality ▪ Communication style *Organizational factors* ▪ Standardized communication ▪ Face-to-face communication *Care complexities* ▪ Opportunities for care coordination and planning	75%
Roberts et al., 2014 (USA)	Identify and understand barriers to calling for urgent assistance where an MET had been implemented.	freestanding 530 bed Children's Hospital 27 nurses 30 physicians caring for patients < 18 yrs on medical or surgical units with either false negative or false positive PEWS following MET	Grounded theory Semi-structured interviews using tool based on literature and expert opinion	*Barriers for initiating MET* ▪ Lack of self-efficacy ▪ Perception of hierarchy ▪ Fear of losing control of patient (MD) ▪ Fear of criticism *Strategies used to mitigate barriers* ▪ Delegating up or conferring with others ▪ Teaming up with others	75%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Theilen et al., 2013 (Scotland)	To evaluate the impact of team training on hospital response to deteriorating patients.	freestanding Children's Hospital All unplanned admissions to PICU for 1 year	Prospective pre/post intervention observational cohort study Chart audit for process measures related to pre-event recognition, escalation, and management, and patient outcomes	▪ Decreased time between warning sign & first response ▪ Increase nursing observations ▪ Increase consultant reviews ▪ Increase patient transfer to higher level of care ▪ Decrease time between first response & PICU admission ▪ No significant change in outcomes but improved trends	75%
Thrasher et al., 2017 (USA)	To evaluate nurses' perceptions of barriers to early clinical intervention and escalation to reduce code events on pediatric inpatient medical units.	82 beds of a 486 bed freestanding Children's Hospital 10 nurses working on 2 pediatric medical units.	Qualitative study using thematic analysis Interviews	*Facilitators in calling RRT:* ▪ Experienced resources ▪ Culture of assertion ▪ Recognition skills ▪ Supportive leadership *Barriers in calling RRT:* ▪ ICU bed capacity ▪ Equipment issues ▪ Lack of experience ▪ Qualities of prior experience with MD ▪ Misinterpretation of cues ▪ Self-expectation to manage deterioration ▪ Delay to escalation up chain of command first ▪ Delay d/t having to convince providers	75%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Voepel-Lewis et al., 2013 (USA)	Describe relationships between patient & periop factors, staffing, surveillance, & SAE. Determine effects of staffing on relationships between patient, periop factors, SAE, & surveillance on	Children's Hospital Children who had non-cardiac surgery with serious event within 7 days post surgery 98 events 158 controls 2 controls matched on surgical procedure	Retrospective, nested case-control correlational study Chart review for nursing surveillance data and patient outcomes Staffing derived from administrative data	▪ Major comorbidity increased surveillance but was dependent on staffing ▪ Relationship between staffing & SAE dependent on surveillance, when adjusted for all factors ▪ Staffing levels without added surveillance was insufficient to impact outcomes ▪ Physical status, periop complication, greater surveillance associated with probability of SAE ▪ SAEs detected during informal/ undocumented surveillance	100%
Watson et al., 2014 (USA)	To evaluate workflow variables surrounding calculation and documentation of PEWS.	7 non-ICU units in a 303 bed freestanding Children's Hospital All patients on unit during data collection times 2583 vital sign instances, 2556 PEWS Random selection of 15 nurses for observation	Mixed-method study Pre/post education program descriptive, observational study Retrospective chart review Behavioral observations PEWS satisfaction question asked at end of observations	▪ Documentation delays in mean mins: vital signs 20-37, PEWS calculation 77-83; delays d/t work, communication, information collection, interventions, RNs taking vital signs ▪ Barriers to concurrent charting: computer unavailability/ functionality, long log-on times, charting away from patients/ families ▪ Median time to assessment 18 mins, documentation 47 mins, communication 30 mins ▪ Use of monitors for vital signs vs. assessment, Assessments written then transcribed to EMR ▪ RN preferred to assess vs. PEWS to determine risk	50%

Note: AVPU = **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; EMR = electronic medical record; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Author, year (Country)	Purpose	Setting Sample	Design Measurement	Results related to Nursing Surveillance	Quality
Ygge & Arnetz, 2004 (Sweden)	Gain an understanding of factors that influence parents' views of their own involvement in pediatric care. Develop a theory about interactions between hospital staff and parents of chronically ill children.	200 bed Children's Hospital 14 parents	Grounded theory Semi-structured interviews	*Themes of parents perceptions/ experiences:* ▪ Need for support: information, guidance, routine for communication or interaction with staff ▪ Professionalism: communication deficiencies about information, participating and individualizing care, concerns about competence ▪ Work environment: staff busy, stressed, time pressured, disorganized, parent expected to stay 24/7 ▪ Responsibility: for care coordination and updated on new research/treatment methods	50%
Zenker et al., 2007 (USA)	To evaluate effectiveness & impact of implementing RRT.	381 bed, Children's Hospitals and Clinics All code and RRT events in non ICU or emergency department	Pre/post intervention, observational, descriptive study Retrospective chart review pre RRT Prospective chart review, RRT consult record and log post RRT Satisfaction questionnaire	▪ Most activations by RNs ▪ 2 activations at the request of parents ▪ More calls on off shifts; winter and spring d/t respiratory illness ▪ 39% of RRT calls within 24 hrs of admission ▪ Objective criteria for call often not documented ▪ Rx's: suctioning, increased oxygenation/ ventilation therapy, vasopressors, fluids, intubation, transfer to higher level of care, cardioversion, increased monitoring	50%

Note: AVPU = level of consciousness assessment: **A**lert, responds to **V**oice, responds to **P**ain, **U**nresponsive; BP = blood pressure; d/t = due to; HR = heart rate;; hrs = hours; ICU = intensive care unit; Med/surg = medical surgical nursing unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RR = respiratory rate; RRT = rapid response team; r/t = related to; Rx = treatment; SA = situation awareness; SAE = serious adverse event; Sp02 = peripheral capillary oxygen saturation; T = temperature; vs = versus; yrs = years

(continued)

Table 2.3
Factors Associated with Nursing Surveillance

Factors		Akre et al. (2010)	Almblad,et al. (2018)	Azzopardi, et al. (2011)	Bonafide et al. (2013)	Brady & Goldenhar (2014)	Brady et al. (2015)	Doman, et al. (2004)	Dudley & Carr (2004)	Gawronski et al. (2018)	Kaul et al. (2014)	Lobos, et al. (2014)	Martin, eta l. (2016)	McKay et al. (2013)	Oliver, et al. (2010)	Reese, et al. (2016)	Roberts et al. (2014)	Theilen et al. (2013)	Thrasher, et al. (2017)	Voepel-Lewis, et al. (2013)	Watson, et al. (2014)	Ygge & Arnetz (2004)	Zenker et al. (2007)
CONDITIONS	FACILITATORS																						
		Parents available for consultation/ care				X	X		X	X												X	X
		Adequate staffing				X				X												X	
		Low staffing ratio																		X			
		Experience with recognition/ management			X		X		X										X				
		Intuition/gut feeling				X		X															
		Education/ knowledge /training			X		X		X		X		X	X				X			X		X
		Confidence/ self-efficacy/ being assertive					X		X			X	X				X						
		Management leadership/ skills/ support		X					X		X								X				
		Availability of electronic monitoring							X												X		
		Shared language of risk and indicators				X	X				X				X	X							
		Standardized assessment method/ treatment guidelines	X			X	X		X		X										X		
		Patient co-morbidities/ surgical patient										X								X			
		Electronic medical record for data trending					X																
		Relationships								X	X												
		Culture of reporting																	X				
		Support structures for handoff/ continuity					X				X												
		Increased patient acuity					X		X											X			
		Not being listened to by providers							X							X							
		Perceived hierarchy			X											X	X		X				
		Inexperienced providers in pediatric care					X		X		X												
	BARRIERS	Lack of experienced clinical resources for consultation					X																
		Lack of resources if patient deteriorates					X		X		X												
		Shift work/duration and change in assignments impacting continuity of care					X				X												
		Lack of continuity of care providers									X												
		Lower resources available on off shifts											X										
		Previous negative encounters with MD														X			X				
		Staff mix									X												

Note: EHR = electronic medical record; ICU = intensive care unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RRT = rapid response team; r/t related to

(continued)

	Factors	Akre et al. (2010)	Almblad,et al. (2018)	Azzopardi, et al. (2011)	Bonafide et al. (2013)	Brady & Goldenhar (2014)	Brady et al. (2015)	Doman, et al. (2004)	Dudley & Carr (2004)	Gawronski et al. (2018)	Kaul et al. (2014)	Lobos, et al. (2014)	Lobos, et al. (2015)	Martin, et al. (2016).	McGillis-Hall et al. (2010)	McKay et al. (2013)	Oliver, et al. (2010)	Reese, et al. (2016)	Roberts et al. (2014)	Theilen et al. (2013)	Thrasher, et al. (2017)	Watson, et al. (2014)	Ygge & Arnetz (2004)	Zenker et al. (2007)
CONTEXT PROCESSES	FACILITATORS					X				X						X		X						
										X													X	X
						X	X		X	X													X	X
						X												X						
						X		X																
						X		X		X														
				X		X												X	X					
		X	X			X										X	X			X		X		X
		X		X						X		X	X			X								X
						X				X								X						
		X						X																
		X			X	X				X	X			X		X						X		
		X			X	X				X	X					X								
								X																
				X		X												X	X					
						X																		
	BARRIERS				X	X				X														
										X					X									
										X											X			
										X														
										X											X			
										X														
																		X						
																		X			X			
																					X			
										X									X					

Note: EHR = electronic medical record; ICU = intensive care unit; MET = medical emergency team; MD = medical doctor; NA = nursing assistant; periop = perioperative; PEWS = pediatric early warning score; PICU = pediatric intensive care unit; RN = registered nurse; RRT = rapid response team; r/t related to

References

Akre, M., Finkelstein, M., Erickson, M., Liu, M., Vanderbilt, L., & Billman, G. (2010). Sensitivity of the pediatric early warning score to identify patient deterioration. *Pediatrics, 125*(4), e763-e769. https://doi.org/10.1542/peds.2009-0338

Almblad, A. C., Siltberg, P., Engvall, G., & Malqvist, M. (2018). Implementation of pediatric early warning score: Adherence to guidelines and influence of context. *Journal of Pediatric Nursing, 38,* 33-39. https://doi.org/10.1016/j.pedn.2017.09.002

Anderson, D. M. (2002). *Mosby's Medical, Nursing, & Allied Health Dictionary* (6th ed.). St. Louis, MO: Mosby.

Andrews, T., & Waterman, H. (2005). Packaging: A grounded theory of how to report physiological deterioration effectively. *Journal of Advanced Nursing, 52*(5), 473-481. https://doi.org/10.1111/j.1365-2648.2005.03615.x

Azzopardi, P., Kinney, S., Moulden, A., & Tibballs, J. (2011). Attitudes and barriers to a medical emergency team system at a tertiary paediatric hospital. *Resuscitation, 82*(2), 167-174. https://doi.org/10.1016/j.resuscitation.2010.10.013

Baird, S. K., & Turbin, L. B. (2011). Condition concern: An innovative response system for enhancing hospitalized patient care and safety. *Journal of Nursing Care Quality, 26*(3), 199-207. https://doi.org/10.1097/NCQ.0b013e31820b1f91

Balling, K., & McCubbin, M. (2001). Hospitalized children with chronic illness: Parental caregiving needs and valuing parental expertise. *Journal of Pediatric Nursing, 16*(2), 110-119. https://doi.org/10.1053/jpdn.2001.23157

Benin, A. L., Borgstrom, C. P., Jenq, G. Y., Roumanis, S. A., & Horwitz, L. I. (2012). Defining impact of a rapid response team: Qualitative study with nurses, physicians and hospital administrators. *BMJ Quality & Safety, 21*(5), 391-398. https://doi.org/10.1136/bmjqs-2011-000390

Benner, P. (1984). *From novice to expert: Excellence and power in clinical nursing practice.* Menlo Park, CA: Addison Wesley.

Berg, M. D., Nadkarni, V. M., Zuercher, M., & Berg, R. A. (2008). In-hospital pediatric arrest. Pediatric Clinics in North America, 55( ), 589-604. https://doi.org/10.1016/j-pcl.2008.02.005

Berger, Z., Flickinger, T. E., Pfoh, E., Martinez, K. A., & Dy, S. M. (2014). Promoting engagement by patients and families to reduce adverse events in acute care settings: A systematic review. *BMJ Quality & Safety, 23*(7), 548-555. https://doi.org/10.1136/bmjqs-2012-001769

Bogert, S., Ferrell, C., & Rutledge, D. N. (2010). Experience with family activation of rapid response teams. *MedSurg Nursing, 19*(4), 215-222.

Bonafide, C. P., Holmes, J. H., Nadkarmi, V. M., Lin, R., Landis, R., & Keren, R. (2012). Development of a score to predict clinical deterioration in hospitalized children. *Journal of Hospital Medicine, 7*(4), 345-349. https://doi.org/10.1002/jhm.971

Bonafide, C. P., Roberts, K. E., Priestly, M. A., Tibbetts, K. M., Huang, E., Nadkarni, V. M., & Keren, R. (2012). Development of a pragmatic measure for evaluating and optimizing rapid response systems. *Pediatrics, 129(4),* e874-e881. https://doi.org/10.1542/peds.2011-2784.

Bonafide, C. P., Roberts, K. E., Weirich, C. M., Paciotti, B., Tibbetts, K. M., Keren, R.,…Homes, J. H. (2013). Beyond statistical prediction: Qualitative evaluation of the mechanisms by which pediatric early warning scores impact patient safety. *Journal of Hospital Medicine, 8*(5), 248-253. https://doi.org/10.1002/jhm.2026

Brady, P. W., & Goldenhar, L. M. (2014). A qualitative study examining the influences on situation awareness and the identification, mitigation and escalation of recognised patient risk. *BMJ Quality & Safety, 23*(2), 153-161. https://doi.org/10.1136/bmjqs-2012-001747

Brady, P. W., Muething, S., Kotagal, U., Ashby, M., Gallagher, R., Hall, D.,…Wheeler, D. S. (2013). Improving situation awareness to reduce unrecognized clinical deterioration and serious safety events. *Pediatrics, 131*(1), e298-e308. https://doi.org/10.1542/peds.2012-1364

Brady, P. W., Zix, J., Brilli, R., Wheeler, D. S., Griffith, K., Giaccone, M. J.,…Tegtmeyer, K. (2015). Developing and evaluating the success of a family activated medical emergency team: A quality improvement report. *BMJ Quality & Safety, 24*(3), 203-211. https://doi.org/10.11336/bmjqs-2014-003001

Brilli, R. J., Gibson, R., Luria, J. W., Wheeler, T. A., Shaw, J., Linam, M.,…McBride, M. (2007). Implementation of a medical emergency team in a large pediatric teaching hospital prevents respiratory and cardiopulmonary arrests outside the intensive care unit. *Pediatric Critical Care Medicine, 8*(3), 236-246. https://doi.org/10.1097/01.PCC.0000262947.72442.EA

Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist, 32*(7), 513-531. https://doi.org/10.1037/0003-066X.32.7.513

Bulechek, G. M., Butcher, H., Dochterman, J. M., & Wagner, C. M. (2013). *Nursing interventions classification (NIC;* 6th ed.). St. Louis, MO: Elsevier.

Bultas, M. W., Hassler, M., Ercole, P. M., & Rea, G. (2014). Effectiveness of high-fidelity simulation for pediatric staff nurse education. *Pediatric Nursing, 40*(1), 27-32, 42.

Cioffi, J. (2000). Recognition of patients who require emergency assistance: A descriptive study. *Heart & Lung, 29*(4), 262-268.

Coyne, I., & Cowley, S. (2007). Challenging the philosophy of partnership with parents: A grounded theory study. *International Journal of Nursing Studies, 44*(6), 893-904. https://doi.org/10.1016/j.ijnurstu.2006.03.002

Cranley, L., Doran, D. M., Tourangeau, A. E., Kushniruk, A., & Nagel, L. (2009). Nurse's uncertainty in decision making: A literature review. *Worldviews of Evidence-Based Nursing, 6*(1), 3-15. https://doi.org/10.1111/j.1741-6787.2008.00138.x

Diehl, S. F., Moffitt, K. A., & Wade, S. M. (1991). Focus group interview with parents of children with medically complex needs: An intimate look at their perceptions and feelings. *Child Health Care, 20*(3), 170-178. https://doi.org/10.1207/s15326888chc2003_6

Doman, M., Prowse, M., & Webb, C. (2004). Exploring nurses' experiences of providing high dependency care in children's wards. *Journal of Child Health Care, 8*(3), 180-197. https://doi.org/10.1177/1367493504045819

Dudley, S. K., & Carr, J. M. (2004). Vigilance: The experience of parents staying at the bedside of hospitalized children. *Journal of Pediatric Nursing, 19*(4), 267-275. https://doi.org/10.1016/j.pedn.2004.05.008

Dunning, E., Brzozowicz, K., Noel, E., O'Keefe, S., Ponischil, R., Sherman, S.,… Westley, M. (2010). FAST track beyond RRTs. *Nursing Management, 41*(5), 36-41. https://doi.org/10.1097/01.NUMA.0000372032.52605.ef

Eckle, N., & MacLean, S. L. (2001). Assessment of family-centered care policies and practices for pediatric patients in nine US emergency departments. *Journal of Emergency Nursing, 27*(3), 238-245. https://doi.org/10.1067/men.2001.115285

Endacott, R., Kidd, T., Chaboyer, W., & Edington J. (2007). Recognition and communication of patient deterioration in a regional hospital: A multi-methods study. *Australian Critical Care, 20*(3), 100-105. https://doi.org/10.1016/j.aucc.2007.05.002

Endacott, R., & Westley, M. (2006). Managing patients at risk for deterioration in rural hospitals: A qualitative study. *Australian Journal of Rural Health, 14*(6), 275-279. https://doi.org/10.1111/j.1440-1584.2006.00829.x

Gawronski, O., Parshuram, C., Cecchetti, C., Tiozzo, E., Coife Degli Atti, M. L., Dall'Oglio, I.,…Latour, J. M. (2018). Qualitative study exploring factors influencing escalation of care of deteriorating children in a children's hospital. *BMJ Paediatrics Open, 2*(1), e000241. https://doi.org/10.1136/bmjpo-2017-000241

Gazarian, P. K., Henneman, E. A., & Chandler, G. E. (2010). Nurse decision making in the prearrest period. *Clinical Nursing Research, 19*(1), 21-37. https://doi.org/10.1177/1054773809353161

Gilfoyle, E., Koot, D. A., Annear, J. C., Bhanji, F., Cheng, A., Duff, J. P.,…Gottesman, R. D. (2017). Improved clinical performance and teamwork of pediatric interprofessional resuscitation teams with a simulation–based educational intervention. *Pediatric Critical Care Medicine, 18*(2), e62-e69. https://doi.org/10.1097/PCC0000000000001025

Goldhill, D. R, White, S. A, & Sumner, A. (1999). Physiological values and procedures in the 24 h before ICU admission from the ward. *Anaesthesia, 54*(6), 529-534. https://doi.org/10.1046/j.1365-2044.1999.00837.x

Greenhouse, P. K., Kuzminsky, B., Martin, S. C., & Merryman, T. (2006). Calling a condition H(elp). *American Journal of Nursing, 106*(11), 63-66.

Hayes, L. W., Dobyns, E. L., DiGiovine, B., Brown, A. M., Jacobson, S., Randall, K. H.,…Markovitz, B. (2012). A multicenter collaborative approach to reducing pediatric codes outside the ICU. *Pediatrics, 129*(3), e785-e791. https://doi.org/10.1542/peds.2011-0227

Hickey, P. A., Gauvreau, K., Curley, M. A., & Connor, J. A. (2013). The effect of critical care nursing and organizational characteristics on pediatric cardiac surgery mortality in the United States. *Journal of Nursing Administration, 43*(12), 637-644. https://doi.org/10.1097/NNA.0000000000000005

Hueckel, R. M., Mericle, J. M., Frush, K., Martin, P. L., & Champagne, M. T. (2012). Implementation of condition help: Family teaching and evaluation of family understanding. *Journal of Nursing Care Quality, 27*(2), 176-181. https://doi.org/10.1097/NCQ.0b013e318235bdec

Joffe, A. R., Anton, N. R., & Burkholder, S. C. (2011). Reduction in hospital mortality over time in a hospital without a pediatric medical emergency team: Limitations of before-and-after study designs. *Archives of Pediatric and Adolescent Medicine, 165*(5), 419-423. https://doi.org/10.1001/archpediatrics,2011.47

Jones, D., Mitchell, I., Hillman, K., & Story, D. (2013). Defining clinical deterioration. *Resuscitation, 84*(8), 1029-1034. https://doi.org/10.1016/j.resiscitation.2013.01.013

Karsh, B. T., Holden, R. J., Alper, S. J., & Or., C.K. (2006). A human factors engineering paradigm for patient safety: Designing to support the performance of the healthcare professional. *Quality and Safety in Health Care, 15*(Suppl. 1), i59-i65. https://doi.org/10.1136/qshc.2005.015974

Kaul, M., Snethen, J., Kelber, S. T., Zimmanck, K., Maletta, K., & Meyer, M. (2014). Implementation of the bedside paediatric early warning system (Bedside PEWS) for nurse identification of deteriorating patients. *Journal of Specialists in Pediatric Nursing, 19*(4), 339-349. https://doi.org/10.1111/jspn.12092

Kelly, L., & Vincent, D. (2011). The dimensions of nursing surveillance: A conceptual analysis. *Journal of Advanced Nursing, 67*(3), 652-661. https://doi.org/10.1111/j.1365-2648.2010.05525.x

King, S. (2006). Our story. *Pediatric Radiology, 36*(4), 284-286. https://doi.org/10.1007/s00247-005-0077-y

Kotsakis, A., Lobos, A. T., Parshuram, C., Gilleland, J., Gaiteiro, R., Mohseni-Bod, H.,…Bohn, D. (2011). Implementation of a multicenter rapid response system in pediatric academic hospitals is effective. *Pediatrics, 128*(1), 72-78. https://doi.org/10.1542/peds.2010-0756

Krapohl, G., Manojlovich, M., Redman, R., & Zhang, L. (2010). Nursing specialty certification and nursing-sensitive patient outcomes in the intensive care unit. *American Journal of Critical Care, 19*(6), 490-498. https://doi.org/10.4037/ajcc2010406

Kristensson-Hallström, I., & Elander, G. (1997). Parents' experience of hospitalization: Different strategies for feeling secure. *Pediatric Nursing, 23*(4), 361-367.

Lobos, A. T., Fernandes, R., Ramsay, T., & McNally, J. D. (2014). Patient characteristics and disposition after pediatric medical emergency team (MET) activation: Disposition depends on who activates the team. *Hospital Pediatrics, 4*(2), 99-105. https://doi.org/10.1542/hpeds.2013-0032

Lobos, A. T., Fernandes, R., Williams, K., Ramsay, C., & McNally, J. D. (2015). Routine medical emergency team assessments of patients discharged from the PICU: Description of a medical emergency team follow-up program. *Pediatric Critical Care Medicine, 16*(4), 359-365. https://doi.org/10.1097/PCC.0000000000000354

Lyndon, A. (2008). Social and environmental conditions creating fluctuating agency for safety in two urban academic birth centers. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 37*(1), 13-33. https://doi.org/10.1111/j.1552-6909.2007.00204.x

Martin, M. G., Keller, L. A., Long, T. L., & Ryan-Wenger, N. A. (2016). High-fidelity simulation effect on nurses' identification of deteriorating pediatric patients. *Clinical Simulation in Nursing, 12*(6), 228-239. https://doi.org/10.1016/j.ecns.2016.01.013

McGillis Hall, L., Pedersen, C., Hubley, P., Ptack, E., Hemingway, A., Watson, C., & Keatings, M. (2010). Interruptions and pediatric patient safety. *Journal of Pediatric Nursing, 25*(3), 167-175. https://doi.org/10.1016/j.pedn.2008.09.005

McKay, H., Mitchell, I. A., Sinn, K., Mugridge, H., Lafferty, T., Van Leuvan, C.,…Abdel-Latif, M. E. (2013). Effect of a multifaceted intervention on documentation of vital signs and staff communication regarding deteriorating paediatric patients. *Journal of Paediatrics and Child Health, 49*(1), 48-56. https://doi.org/10.1111/jpc.12019

McQuillan, P., Pilkington, S., Allan, A., Taylor, B., Short, A., Morgan, G.,…Collins, C. H. (1998). Confidential inquiry into quality of care before admission to intensive care. *British Medical Journal, 316*(7148), 1853-1858. https://doi.org/10.1136/bmj.316.7148.1853

Messmer, P. R. (2008). Enhancing nurse-physician collaboration using pediatric simulation. *Journal of Continuing Education in Nursing, 39*(7), 319-327. https://doi.org/10.3928/00220124-20080701-07

Meyer, G. A., Lavin, M. A., & Perry, A. G. (2007). Is it time for a new category of nursing diagnosis? *International Journal of Nursing Terminologies and Classifications*, *18*(2), 45-50. https://doi.org/10.1111/j.1744-618X.2007.00049.x

Minick, P., & Harvey, S. (2003). The early recognition of patient problems among medical surgical nurses. *MedSurg Nursing, 12*(5), 291- 297.

National Patient Safety Agency. (2007). *Recognising and responding appropriately to early signs of deterioration in hospitalised patients* (NHS publication ISBN: 978-0-9556340-8-6). Retrieved from https://lsbu.rl.talis.com/items/790E7253-11BB-BF21-5AAC-80E4A4D56054.html / Accessed March 10, 2019.

O'Leary, F., McGarvey, K., Christoff, A., Major, J., Lockie, F., Chayen, G.,…Wharton, S. (2014). Identifying incidents of suboptimal care during pediatric emergencies – an observational study utilising in situ simulation centre scenarios. *Resuscitation, 85*(3), 431-436. https://doi.org/10.1016/j.resiscitation.2013.12.001

Oliver, A., Powell, C., Edwards, D., & Mason, B. (2010). Observations and monitoring: Routine practices on the ward. *Pediatric Nursing, 22(4),* 28-32. https://doi.org/10.7748/paed2010.05.22.4.28.c7738

Pace, R., Pluye, P., Bartlett, G., Macaulay, A. C., Salsberg, J., Jagosh, J., & Sellers, R. (2012). Testing the reliability and efficiency of the pilot mixed methods appraisal tool (MMAT) for systematic mixed studies review. *International Journal of Nursing Studies, 49(1),* 47-53. https://doi.org/10.1016/j.ijnurstu.2001.07.002

Paciotti, B., Roberts, K. E., Tibbetts, K. M., Paine, C. W., Keren, R., Barg, F. K.,…Bonafide, C. P. (2014). Physician attitudes toward family-activated medical emergency teams for hospitalized children. *The Joint Commission Journal on Quality and Patient Safety, 40*(4), 187-192. https://doi.org/10.1016/S1553-7250(14)40024-2

Patterson, M. D., Geis, G. L., LeMaster, T., & Wears, R. L. (2013). Impact of multidisciplinary simulation-based training on patient safety in a paediatric emergency department. *BMJ Quality & Safety, 22*(5), 383-393. https://doi.org/10.1136/bmjqs-2012-000951

Pluye, P., Robert, E., Cargo, M., Bartlett, G., O'Cathain, A., Griffiths, F.,…Rousseau, M. C. (2011). *Proposal: A mixed methods appraisal tool for systematic mixed studies reviews.* Retrieved from http://mixedmethodsappraisaltoolpublic.pbworks.com/ Accessed March 11, 2019.

Reese, J., Simmons, R., & Barnard, J. (2016). Assertion practices and beliefs among nurses and physicians on an inpatient pediatric medical unit. *Hospital Pediatrics, 6*(5), 275-281. https://doi.org/10.1542/hpeds.2015-0123

Reynolds, A., Ayres-de-Campos, D., & Lobo, M. (2011). Self-perceived impact of simulation-based training on the management of real-life obstetrical emergencies. *European Journal of Obstetrics, Gynecology, and Reproduction Biology, 159*(1), 72-76. https://doi.org/10.1016/j.ejogrb.2011.07.022

Roberts, K .E., Bonadfide, C., Paine, C. W., Paciotti, B., Tibbetts, K. M., Keren, R.,…Holmes, J. H. (2014). Barriers to calling for urgent assistance despite a comprehensive pediatric rapid response system. *American Journal of Critical Care, 23*(3), 223-229. https://doi.org/10.4037/ajcc2014594

Sedman, A., Harris, J. M., II, Schultz, K., Schwalenstocker, E., Remus, D., Scanlon, M., & Bahl. V. (2005). Relevance of the Agency for Healthcare Research and Quality Patient Safety Indicators for children's hospitals. *Pediatrics, 115*(1), 135-145. https://doi.org/10.1542/peds.2004-1083

Slonim, A. D., LaFleur, B. J., Ahmed, W., & Joseph, J. G. (2003). Hospital-reported medical errors in children. *Pediatrics, 111*(3), 617-621. https://doi.org/10.1542/peds.111.3.617

Stedman, T. L. (2012). *Stedman's medical dictionary for the health professions and nursing* (7th ed.). Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Sutcliffe, K. M., Lewton, E., & Rosenthal, M. M. (2004). Communication failures: An insidious contributor to medical mishaps. *Academic Medicine, 79*(2), 186-194.

Theilen, U., Leonard, P., Jones, P., Ardill, R., Weitz, J., Agrawal, D., & Simpson, D. (2013). Regular in situ simulation training of paediatric medical emergency team improves hospital response to deteriorating patients. *Resuscitation, 84*(2), 218-222. https://doi.org/10.1016/j.resiscitation.2012.06.027

Thomas, E. J., Taggart, B., Crandell, S., Lasky, R. E., Williams, A. L., Love, L. J.,…Helmreich, R. L. (2007). Teaching teamwork during the neonatal resuscitation program: A randomized trial. *Journal of Perinatology, 27*(7), 409-414. https://doi.org/10.1038/sj.jp.7211771

Thompson, R. H. (1986). Where we stand: Twenty years of research on pediatric hospitalization and health care. *Child Health Care, 14*(4), 200-210. https://doi.org/10.1207/s15326888chc1404_3

Thompson, C., Dalgleish, L., Bucknall, T., Estabrooks, C., Hutchinson, A. M., Fraser, K.,…Saunders, J. (2008). The effects of time pressure and experience on nurses' risk assessment decisions: A signal detection analysis. *Nursing Research, 57*(5), 302-311. https://doi.org/10.1097/01.NNR.0000313504.37970.f9

Thrasher, J., McNeely, H. & Adrian, B. (2017). When nursing assertion stops: A qualitative study to examine the cultural barriers involved in escalation of care in a pediatric hospital. *Critical Care Nursing Clinics of North America, 29*(2), 167-176. https://doi.org/10.1016/j.cnc.2017.01.004

Tume, L. (2007). The deterioration of children in ward areas in a specialist children's hospital. *Nursing in Critical Care, 12*(1), 12-19. https://doi.org/10.1111/j.1478-5153.2006.00195.x

Voepel-Lewis, T., Pechlavanidis, E., Burke, C., & Talsma, A. N. (2013). Nursing surveillance moderates the relationship between staffing levels and pediatric postoperative serious adverse events: A nested case-control study. *International Journal of Nursing Studies, 50*(7), 905-913. https://doi.org/10.1016/j.ijnurstu.2012.11.014

Watson, A., Skipper, C., Steury, R., Walsh, H., & Levin, A. (2014). Inpatient nursing care and early warning scores: A workflow mismatch. *Journal of Nursing Care Quality, 29*(3), 215-222. https://doi.org/10.1097/NCQ.0000000000000058

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly, 26*(2), xiii-xxiii. https://doi.org/10.2307/4132319

Weinstock, P. H., Kappus, L. J., Kleinman, M. E., Grenier, B., Hickey, P., & Burns, J. P. (2005). Toward a new paradigm in hospital-based pediatric education: The development of an onsite simulator program. *Pediatric Critical Care Medicine, 6*(6), 635-641.

Whittemore, R., & Knafl, K. (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing, 52*(5), 546-553. https://doi.org/10.1111/j.1365-2648.2005.03621.x

Ygge, B. M., & Arnetz, J. E. (2004). A study of parental involvement in pediatric hospital care: Implications for clinical practice. *Journal of Pediatric Nursing, 19*(3), 217-223. https://doi.org/10.1016/j.pedn.2004.02.005

Zenker, P., Schlesinger, A., Hauck, M., Spencer, S., Hellmich, T., Finkelstein, M.,… Billman, G. (2007). Implementation and impact of a rapid response team in a children's hospital. *The Joint Commission Journal on Quality and Patient Safety, 33*(7), 418-425. https://doi.org/10.1016/S1553-7250(07)33048-1

CHAPTER THREE

NURSING SURVEILLANCE OF CONDITION CHANGES IN NON ICU PEDIATRIC PATIENTS: ACTIONS, FACILITATORS, AND BARRIERS[3]

JAMES R. STOTTS

[3] Manuscript to be submitted to *Journal of Advanced Nursing*

Abstract

Aims

To discern the surveillance activities of acute care pediatric nurses in the setting of patient instability, and to further delineate the individual, interpersonal, and environmental factors that impact all aspects of nursing surveillance.

Design

Grounded theory qualitative methodology was used for data collection and analysis.

Methods

Observation and interviews were conducted between June 2018 and January 2019 with 13 pediatric nurses and 16 parents of pediatric parents in non ICU environments in an academic children's hospital in the Northwest USA.

Results

Maintaining perspective on managing instability was the central action of nursing surveillance which was influenced by safety culture, unit resilience, nurse knowledge and experience, family presence, and systems for managing clinical data and calling for help. Nursing surveillance actions included establishing a baseline, anticipating risk, noticing, evaluating, managing, and escalating.

Conclusion

Strategies to improve early identification and management of pediatric patient instability will need to focus on 1) augmenting resource availability, 2) collaboration between parents and nurses, 3) opportunities for contingency planning and 4) providing redundant alerting systems.

Introduction

Since the first report of the Committee on the Quality of Health Care in America, *To Err is Human: Building a Safer Health System* announced between 44,000 and 98,000 medical error related deaths occur in US hospitals annually (Kohn et al., 2000) a number of studies have examined factors associated with the occurrence of adverse events in hospitalized patients and ways to prevent them. This work has focused on identifying interrelated factors which moderate or mediate harm, profiling patients at risk,and testing intervention strategies to prevent or mitigate adverse events.

A number of individual and organizational characteristics are thought to impact outcomes of hospitalized pediatric patients (Hickey, Gauvreau, Curley, & Connor, 2013; Mark, Harless, & Berman, 2007; Krapohl, Manojlovich, Redman, & Zhang, 2010; Pollack et al, 1994; Profit et al., 2010; Tibby, Correa-West, Durward, Ferguson, Murdoch, 2004). Research looking at how nursing activities impact patient outcomes, using pediatric nurses as subjects and/or conducted in children's hospitals is limited, and has focused only on critical care environments.

Background

Identification of physiologic changes in children hospitalized in non-ICU settings has historically relied on intermittent clinical assessment and vital sign monitoring. Research suggests, however, variability in assessment practices, failure to recognize signs of deterioration, or failure to escalate for additional treatment contributes to suboptimal treatment for instability in non-ICU settings (Hanson, 2010; Hayes et al., 2012; O'Leary et al., 2014; Reis et al., 2002; Tume, 2007; Watson, Skipper, Steury, Walsh, & Levin, 2014). Analysis of adverse events reveals that up to 19% can be attributed to failed escalation (Hayes et al., 2012) and there is documentation of evidence of instability or elevated nurse concern in 64-95% of cases prior to the event (Hanson, 2010; Reis et al., 2002; Tume, 2007).

Adjuncts such as noninvasive monitoring and track-and-trigger mechanisms intended to promote escalation and expand the breadth of surveillance have not shown consistent effects on expediting detection or early intervention (Lambert, Matthews, MacDonell, & Fitzsimons, 2017; Parshuram et al., 2018; Taenzer, Pyke, McGrath, & Blike, 2010; van Loon, van Zaane, Bosch, Kalkman, & Peelen, 2015). More recently failures of rescue seem to be contingent not only on the ability of clinicians to see and act but also on interactions within the clinical environment such as distractions, communication methods and situation awareness (Azzoardi, Kinney, Moulden, Tibballs, 2011; Brady & Goldenhar, 2014; Brady et al., 2013; Hayes et al., 2012; Joffe, Anton, & Burkholder, 2011). This has led some to opine that to improve detection of condition changes a multipronged approach is needed including cultural and system change, education, as well as enhanced monitoring capability and early warning mechanisms (DeVita et al., 2010; Hayes et al., 2012; Kyriacos, 2011; McCurdy, & Wood, 2012; McNeill, & Bryden, 2013; Robb & Seddon, 2010; Shearer et al., 2012).

Nursing surveillance is defined as a process of patient data acquisition, interpretation, and synthesis and decision making about intervention and threats to health and safety (Bulechek, Butcher, Dochterman, & Wagner, 2018; Meyer, Lavin, & Perry, 2007; Kelly & Vincent, 2011). General activities of surveillance have been well described (Bulechek, Butcher, Dochterman, & Wagner, 2018) but without qualifiers and context that suggests facilitators or barriers. How pediatric nurses perform surveillance activities in the context of condition changes has also not been reviewed. Conceptual models of surveillance suggest work environment conditions and nurse, patient, and family characteristics that influence surveillance activities (Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Henneman, Gawlinski, & Giuliano, 2012; Kelly & Vincent, 2011; Kutney-Lee, Lake, & Aiken, 2009) which have been substantiated with studies in adult

patients but not in pediatrics (Andrews & Waterman, 2005; Astroth, Woith, Stapleton, Degitz, & Jenkins, 2012; Cioffi, 2000a; Cioffi, 2000b; Cox, James, & Hunt, 2006; Cutler, 2002; Endacott, Kidd, Chaboyer, & Edington, 2007; Gazarian, Henneman & Chandler, 2010; Kenward & Hodgetts, 2002; Minick & Harvey, 2003; Wheatley, 2006). Benner, Hooper-Kyriakidis, and Stannard (2011) studied how nurses thought about and acted on clinical situations. They showcased through narratives the positive influence that experience, practice (both simulated and experiential), familiarity with patients, and availability of experienced coaches had on nurses' ability to recognize and respond to changes in patient condition. Their findings were based on a total sample of 205 nurses (staff and advanced practice) from a wide range of clinical areas and specialties, a majority from critical care (neonatal, pediatric, and adult), but only 6 acute care pediatric nurses.

Only two studies have looked at aspects of surveillance in pediatric acute care settings. Brady & Goldenhar (2014) found that social, technological, and organizational conditions impacted situation awareness and planning for pediatric patients at risk for potential deterioration. These conditions included family, nurse, and team characteristics as well as processes that supported communication, safety culture, teamwork, and data trending. Gawronski et al. (2018) found that family empowerment, nursing skill and support for recognizing and responding to deterioration, interprofessional dynamics, and organizational processes for communication and resource utilization were contributing factors to failures in escalation.

We set out to discern the surveillance activities of acute care pediatric nurses in the setting of patient instability, and to further delineate the individual, interpersonal, and environmental factors that impact all facets of nursing surveillance.

Methods

The study was carried out at a regional quaternary referral academic medical center located in the northwest U.S.A. which houses a 289 bed children's hospital. Purposive sampling was initially used to recruit nurse participants. We recruited nurses via flyers, announcements, and referrals. Nurses were English speaking, worked at least 20 hours/week, with a minimum of 6 months experience on a pediatric acute care unit. One researcher enrolled participants (JRS) following review of the research protocol and after informed content was given. Participants received a $20 gift card as a token of appreciation.

The study used grounded theory as a qualitative methodology. Grounded theory is used to explore actions and interactions within a social situation for the purpose of developing theory about a social phenomenon. The study design was approved by the institutional review board.

Data was collected between June 2018 and January 2019 by one researcher (JRS) through individual or group interviews, observations, and review of unit and hospital materials designed to facilitate recognition and management of patient condition changes. Semi-structured/open-ended questions designed to explore perceptions about facilitators and barriers to nursing surveillance guided interviews (Table 3.1). Guides were reviewed by other nurse researchers and edited before initiation of interviews. Spontaneous probing of responses allowed for clarification or further exploration of topics raised by participants or of interest to the researcher. Interviews were conducted either by phone or in person at a location determined by the participant. Interviews were audio-recorded, professionally transcribed, de-identified and archived using encrypted procedures.

Observations were conducted by shadowing of a purposive sample of nursing staff during 2 hours of their regular work activities. Verbal consent for observation was obtained by all healthcare workers and parents involved in observation experiences. Policies, procedures,

educational materials, and job aids were reviewed during observation sessions and notes taken on how they impacted nursing surveillance. Field notes were transcribed soon after observational experiences. Prior to and during data collection participants were assured of confidentiality and data anonymity. Interviews and observations continued using theoretical sampling until data redundancy was achieved and dimensions of experiences and properties of dimensions were fully developed. Descriptive statistics were used to portray participant characteristics. Data was analyzed using Atlas.ti v.8.3 qualitative data management software.

Consistent with grounded theory tradition, data analysis occurred iteratively and concurrently with data collection (Glaser and Strauss, 1967). We used constant comparison to make comparisons between data elements and look for similarities, consistencies and differences while data were collected, coded, and analyzed (Glaser & Strauss, 1967). Transcripts and field notes were initially read and coded as interpretative words or phrases to characterize the meanings or actions associated with patient surveillance (Charmaz, 2014).

Codes were then clustered into categories. As categories were developed, properties and relationships of codes and categories were refined with further data collection and analysis. Memoing was used to explore, illustrate, and organize the data, think theoretically about associations between codes and categories, develop concepts, and reflexively consider the researcher's impact on study procedures (Charmaz, 2014). Mapping procedures of situational analysis were used to critically examine the composition and dynamic forces at play in the social context of surveillance of hospitalized children (Clark, 2003). Situational, social worlds and arena, and positional maps helped to layout and analyze relationships between major human and nonhuman actors and their interactions during surveillance.

Theoretical codes were developed to reflect abstract constructions of relationships between codes, categories, and concepts. These constructions were further interrogated using dimensional analysis. Dimensional analysis examines the dimensions or attributes of a social process (context, conditions, actions/processes, and consequences) from different perspectives, thereby helping the researcher to select a perspective that best fits the data and addresses the study aims (Schatzman, 1991). Dimensionalizing assists in transitioning theoretical coding to richer explanations of social experiences (Kools, McCarthy, Durham, & Rocbrecht, 1996).

Rigor was maintained by adherence to grounded theory methodology principles. Memoing and peer checking was used to evaluate researcher positionality. Multiple sources of data enhanced data trustworthiness. Developing analysis was shared with a group of qualitative researchers for ongoing feedback and expert review. Member checking during successive interviews, triangulation and reflection were used to evaluate the quality of data synthesis.

Results

We recruited nurse participants from medical/surgical acute care and transitional care, or hematology/oncology/blood and marrow transplant units. These units were staffed with 3-4 patients per nurse, with an additional supervisory (charge) nurse in the count to manage shift operations, and a resource nurse who was responsible for break relief and nursing support. Thirteen nurses enrolled in the study. Four nurses (1 charge nurse, 3 bedside nurses) were observed during clinical work for a total of 8 hours of shadow observation. Participant characteristics are displayed in Table 3.2.

Nurse interviews and observations signaled aspects of a sociotechnical system that facilitated and encumbered activities of nursing surveillance. In Table 3.3 we have presented our findings in an explanatory matrix configured from a central point of view of *maintaining perspective on changes in patient stability within a sociotechnical system*. We use the terms

instability or condition change to represent a change in vital signs or worsening signs and symptoms resulting in increased surveillance, restorative measures, transfer to a higher level of care, cardiopulmonary demise or death (Bonafide et al., 2013; Jones, Mitchell, Hillman, & Story, 2013).

Maintaining perspective on changes in patient stability within a sociotechnical system

We conceptualize surveillance as a process that occurs within a system of social structures, interactions, and technology (Effken, 2002; Carayon, Bass, Bellandi, & Gurses, 2011) (Figure 3.3). Dimensions of a socio-technical system encompass the people (e.g. nurses, physicians, parents, and patients) and the social structures (e.g. procedures, norms, environment, technology) and how they interact during social processes of thinking, working, and decision making during care delivery (Carayon et al., 2006; Spath, 2011). We chose "maintaining perspective" as the overarching action because it implies efforts to maintain focus and objectivity, while considering different points of view. These points of view reflect the opinions and experiences of nurses, parents, physicians, and patients which nurses consider during interpretation of signs and symptoms and decision making about intervention. Maintaining perspective on changes in patient stability is the goal of nursing surveillance; a process that is part of, and influenced by, a complete situation and its context: the sociotechnical system. What follows is our analysis of how the context and conditions of the sociotechnical system in this study influenced the processes and consequences of maintaining perspective on changes in patient stability.

Context: Safety Culture

The interactions and relationships among the clinical team influenced how condition changes were anticipated, discussed, and managed. Opportunities for discussing patient status,

treatments, and disposition, such as multidisciplinary rounds during day, evening, and night helped to establish common goals, identify patients at risk (watchers), and formulate contingency plans. When nurses weren't included in or didn't attend rounds, communication was fragmented, resulting in perspective discontinuity (i.e. failures in executing plans, missed or delayed care).

Opportunities for clinicians to learn and work together such as participation in mock codes and projects, and working with consistent people fostered team cohesion and like-mindedness. This translated into common understandings of what to monitor, how to treat instability, and knowing ways to assist one another when a patient deteriorated. This is demonstrated in an exemplar in which a nurse was managing a change in the patient condition with an attending.

> They've got a [transfusion] reaction, I'm going to go give them Benadryl. Did you want me to give Hydrocortisone too?" Or usually we'll say, "Let's give the Benadryl see how they do, give them a few minutes and then we'll start Hydrocortisone if they need it." But we'll already have it ready. If it's the attending, we will still speak up and say, "What do you think?" I actually have a little bit more of a conversation, say, "What do you think then?" "I'm kind of getting worried, what about you? So we'll give them that nudge and say...just check in. But they're usually pretty good about it. I don't feel like our Attendings push back that much or try to treat farther than they really feel comfortable. RN_06

When communication was demeaning, or when clinical findings were dismissed the ability to maintain perspective was altered resulting in reduced patient surveillance and treatment.

> I feel like if I am working with a team member who doesn't necessarily agree or a resident who doesn't value my opinion then I feel like that it is harder to work with that person in a way that will respect what I say and my assessment of my patient. I think that culture matters a lot when it comes to these types of patients. I think that unfortunately that teams goes through these things, the closer they become the more supportive the culture becomes. RN_02

Clinical and administrative leaders fostered a culture of safety by creating mechanisms for maintaining focus on patient stability. These included training on effective listening and communication, forums for interdisciplinary care planning, accessibility to equipment and

supplies, and promoting processes to escalate concerning patient situations and speak-up for resources when patient acuity changes. Tools and systems were in place that fostered nurse autonomy for early identification of patient risk and intervention such as a pediatric early warning system (PEWS), the rapid response team (RRT), and physician orders with latitude to treat a range of symptoms. One nurse manager expressed her observations about how the culture in this environment impacted patient outcomes:

> A culture where communication is valued, and the team works together, really work closely together, I think there's better communication, and better alignment of opinions. The residents and Attendings will trust nursing judgment more as they work together more. I think that's really important to foster professional communication and doing things together - education, communication. I also think that patient safety is enhanced when nurses feel supported in terms of staffing, feeling like they have the tools, and the wherewithal to provide the best care. RN_03

Conditions that facilitate, block or shape actions or interactions

Unit resilience.

Nurses discussed a number of conditions that impacted surveillance such as unit layout and staffing and processes in place to compensate for deficiencies. Their unit was designed with long angular hallways with multiple workspaces for nurses to congregate. This design resulted in increased travel time and decreased time spent with patients. It also reduced patient visibility and the ability for nurses to hear when patients were in distress or if nurses needed help.

The use of sitters, remote monitoring with video cameras, or physiologic monitoring were ways nurses improved surveillance for patients that were difficult to see or hear. These strategies, along with patient placement near nursing work areas, were especially helpful in augmenting surveillance for patients who were non-verbal or developmentally delayed without parents at the bedside.

Nurses had flexibility in their assignments and staffing resources to assist when a patient's condition changed. Attempts were made to cluster patient assignments and balance

acuity to maximize time spent with each patient. There were multiple forums each day during which staffing and patient status were reviewed on the unit and at the hospital level to evaluate the need for allocation of nurses or unlicensed personnel. If a patient's condition worsened, nurses had flexibility to adjust their break times so they could be available to monitor the patient. When patients became unstable, nurse assisted each other to watch the other patients, or patients were reassigned. Nurses could adjust break times and negotiate for increased staff surveillance while on break for patients they were concerned about.

There were multiple ways for nurses to alert one another for help and maintain situation awareness about patient risk. At the beginning of each shift the charge nurse briefed all staff about patients who were vulnerable (e.g., patients without parents or very young) or at risk of instability such as patients admitted for seizure monitoring. Each nurse carried a phone for communication, which also alerted staff when concerning conditions occurred such as when vital signs exceeded set limits, or a patient got out of bed. Nurses also used staff assist buttons located above each bed alarmed in the unit overhead to notify others when help was needed. Lastly there was an esprit to corps lauded by nurses that cultivated teamwork and cross-checking behaviors.

> And so do I think that we're all really supportive of each other and when that Staff Assist light goes off, we still do our best to support staff, support our coworkers, that culture? That culture exists. The concept of nobody's going to, we're not going to let anybody drown, if we know they they're drowning. RN_09

Nurse knowledge and experience.

Nurses and families acknowledged the importance of 'knowing the patient' as a facilitator for anticipating risk and knowing how to respond to instability. Knowing the patient came in part from working with the same patient repeatedly. This provided opportunities to see manifestations of the patient's illness and response to treatment over time. Parents characterized 'good nurses' as those who were attentive and engaged with the patient and family on a personal

level. Parents felt assured their child would be watched more closely with this level of familiarity.

Breadth of experience from working with multiple patients over time and similar patients provided nurses with a bank of experiences to draw from when evaluating condition changes in patients. Being put in situations with unfamiliar patients (e.g., floating) and a lack of confidence in clinical assessments or knowing what to do were identified as precursor conditions for failing to recognize the significance of changes and possible delays in initiating treatment. Education and training, years of experience, assignments with the same or similar patients, and availability, accessibility, and approachability of experienced clinicians as resources were noted as conditions that mitigated the lack of familiarity or self-confidence.

> A lot of oncology and BMT patients are kind of, not clock work, but you know, things kind of happen in a recognizable pattern. Like they catch a fever, you know they could decompensate and their blood pressure could drop. RN_01

> I am floated to the ICN once in a while and I hate it because I do not know if I'm going to pick up if something is actually wrong. I'd say I'm not as familiar with the little two kilogram babies and everything looks a little bit off with them. So when I don't trust that I'll be able to pick up on it, as well as I feel like I will be able to with the patients I'm more used to. RN_13

Availability of equipment and supplies.

Nurses applied electronic cardiac or respiratory physiologic monitoring to patients they were concerned might deteriorate. When patient parameters were out of range alarms sounded at the bedside and the central monitors, and nurses would receive alerts on their phones. Phone alerts transmitted to the nurse assigned to the patient as well as the charge nurse, and nurses who were assigned to cover breaks. These alarms and alerts created redundant systems for maintaining nurse and unit awareness of patients at risk for instability. Artifact caused additional work required to troubleshoot false alarms and was identified as a distractor causing alarm fatigue and potential delays in response.

Emergency equipment and trays of supplies used in urgent situations were placed in accessible locations with signage that facilitated easy identification. In anticipation of potential deterioration nurses would assemble supplies they might need at the bedside for quick and easy access, such as for suctioning or increased oxygenation. Having equipment and supplies readily available and accessible, and managers who supported systems for having supplies at the bedside were identified as facilitators for recognizing when a patient became unstable and as means for early intervention.

> The checks in the room are typically what we anticipate the patient may need. For example, if it is a seizure patient that may or may not have desaturation, but if we know that they have a seizure disorder or are being admitted for seizure, we would make sure that our suction equipment is set up and functioning, that we had the appropriate O2 flow meter, any other emergency equipment that we might need to set up ahead of time. Some patients, we would set up an ambu bag at the bedside or a non-rebreather or just a regular O2 set up and ready to go. RN_05

Systems for managing clinical data.

The availability of pertinent patient data influenced the nurses' ability to maintain awareness of patient risk and plan for prevention measures. Having data related to nursing care (e.g., active orders, patient preferences, care plan, teaching needs) assembled together in one screen helped nurses prioritize and plan care for each patient. When data retrieval required hunting or multiple clicks, or if nurses did not indicate task completion within the medical record, it resulted in fragmented information, duplicative efforts, and delays in patient care.

Nurse opinions about the value of PEWS in maintaining perspective on stability were mixed. Most believed the PEWS had value in identifying and trending patient risk for deterioration. However, barriers to its efficacy included a lack of adoption by all nurses, the perception the PEW score was over-sensitive for complex, chronically ill patients, and a lack of reinforcement when physicians and administrative leaders didn't make adjustments in monitoring, treatment, or resource allocation for patients identified at risk.

Standardization of handover processes (e.g., scripting of elements in verbal handover, workflow standards for bedside rounding) improved the quality of information exchange and in turn improved situation awareness of patient risk. Bedside rounding provided a means for cross-checking availability of equipment and supplies, and integrity of equipment functioning with patients with potential for decompensation. Inaccurate handover information could result in misallocation of staffing resources and delays in intervention as noted in one nurse's account of a patient who was much sicker than conveyed in report. In this situation handover information portrayed the patient as stable. Though he was receiving palliative care and neurologically impaired the patient had been able to communicate by blinking his eyes.

> For me that was my first day shift alone as a new grad and so acuity wise you give new grads something that is appropriate...from my report overnight he was comfortable, there was no signs of pain or distress...For me the plan of the day seemed to be...doing total care, keeping him comfortable, rotating him and monitoring his status...after report he was not blinking anymore, blood pressures were sagging lower and lower. The parents were fixated on the monitor essentially and would not leave that bedside. RN_11

Systems for calling for help.

Availability and accessibility to consultants and redundant systems for escalation provided assistance in identifying patients at risk, evaluating patient instability, and managing deterioration. Patients were clustered onto service specific units which had physician workrooms, making physician consultation readily available at most hours of the day and night. The RRT was available and well-advertised to assist with evaluation and/or management of concerning patients. Hospitalists and ICU physicians were in house as back-up for physician trainees and consultation about disposition and management of patients with evolving instability.

> We all go meet in the PICU, all of the units except for the ITM because the babies can't go. C6, C5, and cardiac ICU and cardiac physicians. So we all meet in the PICU with the hospitalist or the PICU attending on that night with the nursing supervisor. And we talk about all of the kids in PICU, what beds we have available, who are we worried about on my unit. If we're worried about them, what are we worried about, why. We express our needs and then we'll say, "Yeah, kind of keep your eyes and ears open because we might be sending them down in a little, or might be calling you guys. RN_06

The use of in-house mobile phones and pagers both enhanced and impeded communication about patients. The use of phones for calling and texting aided two-way communication about patient data and in some cases relaying physician orders. An informal nomenclature was used to indicate severity of the message and urgency of response from the receiver, for example STAT for call right away, 911 for come to the bedside, urgent, and FYI. However, transmission of pages and texts were either delayed or never received, requiring nurses to re-page or text if there was no answer within a tolerable wait time; a time that varied depending on situation and clinician. Reaching on-call and off-service physicians was sometimes difficult because of changes in on-call schedule and incorrect paging numbers. The unreliability of texting and paging contributed to delays in communication about evolving patient situations and treatment.

> In general, I will try to page them in multiple ways. Like I will send a message in pagerbox with what is going on. And then I'll use the on-call pager, if it's the one that's working. Because it's a little bit hard, or you are unsure if that is the correct pager to use because, just because I work nights. Sometimes that is a little more challenging. Then usually, if I don't hear from them, like depending on how concerned I am for the patient, the next thing we have the green team attending who is on overnight, so I usually will contact them. And either have them help me figure out how to contact the primary team or have them come in and assess the patient. And then if worse comes to worse we could always do a RRT. RN_01

Family presence.

Depending on the interactions between the family and the nurse, family presence at the bedside either facilitated surveillance or interfered with it. Parents often spent a great deal of time in the patient's room and assisted with or provided most of the care for the patient including some activities normally completed by nurses such as keeping track of intake and output, initiating feedings and dressing changes. Parents provided baseline and on-going assessment data about the patient's condition which was an asset to nurses for knowing how to interpret future assessment findings and anticipate management for potential patient adverse responses.

> A lot of the times, parents have been the huge factor in terms of indicating acute changes that I can't see as obviously as they can. So it's the parents' contribution, it's a lot of the time the vitals and reassessment and multiple reassessments that really kind of gauge whether or not they're going south. RN_11

If parents failed to point out abnormal conditions, did not include the nurse when treatments were done by the family, or prevented the nurse from evaluating the patient or completing tasks, the nurse's ability to monitor the patient's condition and intervene if needed was impeded. Frequent calls for assistance by the family at times disrupted the nurse's attention on surveillance of patients. This disruption in focus was related to distraction and alert fatigue. Patients or families who interfered with patient observation delayed recognition, and forced nurses to rely on more overt signs and symptoms as markers of condition changes.

Processes: Actions Nurses Engaged in to Maintain Perspective on Patient Stability

Establishing a baseline.

Nurses developed an initial profile of patient acuity based on vital signs, medication, treatment, and patient responses given during handover report. Nurses evaluated information trustworthiness based on comprehensiveness and the quality of reports received from individuals on previous occasions. Nurses were observed to consult the medical record to review provider orders, obtain test results, validate medications given and scheduled, and clarify aspects of the patient's medical history and plan. Experience with chart navigation, and segregation of nursing tasks facilitated information review within the electronic medical record.

Bedside rounding with the off-going nurse facilitated confirmation of report content. Once in the room, nurses relied heavily on their initial interaction with the patient to establish a baseline assessment of stability. The presence of parents knowledgeable about their child's illness helped to corroborate assessments and identify changes. Availability of clinicians with

recent experience caring for the patient assisted with substantiating concerning trends or conditions.

> If I don't know a patient, I really utilize the [medical] team. Recognizing that they're potentially more consistent [present on consecutive days] than nurses...for example if I'm wondering if a patient looks more swollen than yesterday...I might ask the physician team who would've been there yesterday. RN_12

Anticipating risk of deterioration.

Knowledge of illness trajectories and predictable adverse reactions to medications or treatments, experience with individual patient responses, and early warning triggering systems were sources used by nurses in charge and bedside nurses to identify 'watchers' or patients at risk for instability. Higher risk patients were assigned to nurses with more experience and paired with patients closer together and less acuity. Parents were noted to forewarn nurses of potential patient reactions to medications or treatments. Nurses in charge heightened awareness of unit watchers among staff, providers (physicians, nurse practitioners, and physician assistants), and administrators at scheduled huddles, rounds, and patient placement meetings. Contingency planning for potential instability included patient evaluation by the intensive care physician, determining bed availability in critical care units, and evaluating staffing flexibility among the units. Contingency planning focused mostly on patient disposition and resource allocation versus active planning for what to do if a patient becomes unstable.

> Typically, as the charge nurse too, we talk about this at the charge-to-charge report, and also, we do this as the management team with the charge nurse, if there's anyone in the unit that they are concerned about, patients that are on a high-risk medication, any events overnight that might be concerning. We always talk about not just the patients that are sick on the floor, but patients that they are...like the watchers. Typically, we would say, "Who are you concerned about? Who are the watchers? RN_05

Bedside nurses prepared for potential instability by setting up emergency equipment, putting a patient on physiologic monitoring for increased surveillance of vital signs, and ensuring patent intravenous access. For concerning situations, nurses made adjustments in their assigned

break times or coverage and stayed in the room during treatments in order to intensify patient monitoring.

Noticing.

Nurses commented that noticing changes in patient condition depended on experience, the presence of parents, situation awareness, and confidence. Noticing was enhanced with experiences with a single patient overtime which provided a deeper grasp of individual subtleties, and familiarity with multiple patients which supplied a broader understanding of the range and patterns of patient responses. Having parents present who were well versed in their child's illness was a facilitator to noticing changes. Parents often noticed differences in their child's behavior or appearance and in some cases initiated emergency measures. Electronic surveillance assisted in alerting nurses to potential changes, despite the distractions associated with troubleshooting false alarms. Being aware enhanced recognition, sometimes described as instinct, intuition, a sense, or gut response. Nurses recounted stories of "noticing out of the corner of my eye" or "just walking by and noticed" something that didn't look right, or a slight change in patient condition. These nuanced findings led to more thorough investigation and ultimately treatment for an exacerbation of an underlying ailment. Experience and self-confidence fueled the likelihood of further investigation or action on a suspicion. To nuture nurses' confidence to report concerns or the need for help, administrative and clinical leaders emphasized the importance of escalation and respectful listening to the patient and to other clinicians as cultural influences on effective surveillance.

> Our seasoned nurses are phenomenal in terms of knowledge bank wise, they are the richest resource for our unit and I think that their ability to spread that knowledge to the newer nurses and empower us to speak up and be wrong, and it's okay to be wrong, but it's good to vocalize and advocate for your patient. They make it more acceptable to feel confident in speaking out when you feel uncomfortable with the patient's status. We, in our unit, don't shame each other and I feel like that's what makes it a better team dynamic. RN_11

Evaluating.

Patients who show early warnings of instability prompted intensified efforts for monitoring or symptomatic relief. Often parents, and in some cases, unlicensed personnel, initiated the alert to concerning findings. Parents provided context for presenting signs and symptoms. In these situations, nurses described increasing the frequency and duration of patient evaluations. Nurses positioned their work station closer to the patient often planting themselves in the patient's room. Signs and symptoms were quantified and trended. Observations included more frequent vital sign checks, focal system exams (e.g. neuro exams, pulse checks, level of consciousness), and overall assessments of comfort and behavior. Nurses validated findings with other nurses and clinicians to ensure an accurate assessment. Nurses sought consensus from other nurses for more emergent situations to support their decisions in how to intervene such as calling the RRT.

> I'll usually tell the charge nurse or another nurse I trust, maybe to go eyeball and be like, "What do you think? Do you think they're breathing a little harder or look a little bit worse?" And I'll also tell the resident or the nurse practitioner, whoever is taking care of them to come and take a peek. RN_13

Availability of working equipment facilitated patient evaluation. Troubleshooting a clean signal and differentiating artifact during physiologic monitoring caused delays in determining to true abnormalities worthy of further investigation. Having time to thoroughly evaluate and determine causality to a change in patient condition, while coordinating care of other patients was identified as a great challenge. Flexibility in reallocating resources or shifting assignments and team support in caring for a nurse's other patients facilitated the evaluation of unstable patients.

> I'll usually tell the charge nurse or another nurse I trust, maybe to go eyeball and be like, "What do you think? Do you think they're breathing a little harder or look a little bit worse?" And I'll also tell the resident or the nurse practitioner, whoever is taking care of them to come and take a peek. RN_13

Managing.

During the initial stages of deterioration, nurses engaged in trials of intervention coupled with short-term intensive monitoring for stabilizing their patients. The nurse or family repositioned the patient's body or head to improve ventilation or prevent injury or aspiration. Oxygen was applied or increased, or delivery stepped-up; the patient's nose or throat suctioned to remove obstruction and increase oxygenation. Patients were coached to cough and deep breath. Intravenous access was initiated in preparation of administering fluids or medications. Nurses administered rescue medications such as anti-epileptics, anti-inflammatory, analgesics or anxiolytics to reverse symptoms. Parents assisted by giving input about the efficacy of relieving measures.

Nurses marshalled resources in preparation for further diagnostic testing, intervention, or transfer. The patient was put on physiologic monitoring. Equipment was brought into the room such as the code cart or other supplies in anticipation of emergency treatment. Anticipated laboratory tests were either set up or drawn. Respiratory therapists were consulted for treatments; radiology technicians were alerted for bedside imaging; pharmacists consulted on possible adverse drug reactions; the intensive care unit was prepped to accept a possible transfer. Supervisory nurses, nurses on the floor, and providers were called to assist with evaluation and management.

> When I feel like a patient is starting to become unstable, I make sure they are hooked up to monitors, I vital sign them and make sure I have a more up to date vital signs, if it is someone that is decompensating respiratory wise, making sure they have oxygen on, or if not, put it on, reaching out to other members of my team and charge nurse pretty quickly, reaching out to the residents for that patient pretty quickly, and then depending on the situation, like if they are seizing, getting their rescue medication...I always make sure they have access available RN_02

> And then other systems issues might be knowing where to get things. Like can that drug be overridden from our Pyxis [medication station] or does the pharmacy need a runoff somewhere else? Things that took time that maybe there was a more efficient way that could have been done.

> Maybe people didn't know a particular item was in the code cart and they run for it somewhere else. Where it would have been more efficient to just take it from the code cart. RN_10

Nurses commented about the importance of teamwork among nurses and with physicians for effectively managing deterioration. Barriers in communication or working together led to disagreements, uncoordinated care, lack of trust, and feelings of disrespect. Nurses reported working with people they knew, shared patient experiences, and group training enhanced team dynamics.

> If I feel comfortable with the team that's on, and my opinion and assessments then I think anything that happens that day goes more smoothly. If feel like if I am working with a team member who doesn't necessarily agree, or a resident who doesn't value my opinion it is harder to work with that person. RN_02

Escalating.

Before escalation, nurses often first looked to their peers for support in validating findings, deciding the course of action, and for assistance with managing patients. Fear of reprisal from physicians was a deterrent to calling the RRT. Lack of self-confidence about their findings, lack of awareness of changes and the need for additional support, and an off-putting demeanor of supervisory nurses were barriers to nurses escalating to other nurses for help. Often time parents were the first to recognize urgent situations and call for someone to evaluate the patient. Supervisory nurses triaged tasks to other nurses, marshalled resources from other departments, coordinated transfer preparations, and provided consultation on further escalation.

> The first thing I did was I called in the doctor. Second thing I did, as soon as I got off the phone, I called the charge nurse to get oxygen at the bedside for me. And then once it escalated, 'cause calling in an RRT sometimes takes a quick minute, but I pressed the staff assist button, just to get more hands in there. RN_12

Escalation to senior clinicians or calling the RRT occurred usually only after first consulting junior physicians. Nurses reported that junior physicians preferred to manage patients on their own before escalating. Nurses surmised this was attributed to the desire to learn from

the experience, fear of reprisal, or concerns about losing control over patient management. Nurses relayed experiences of having to oblige physicians with periods of intervention trials and watchful waiting to see if patients stabilized before further escalation and in some instanced rebuttal for calling the RRT. Advantages to the nurses for calling the RRT were the additional resources it brought, namely a respiratory therapist, an ICU physician, the hospital nursing supervisor[2], and an ICU nurse. In some instances, nurses overruled the physician's request to delay escalation, when the nurse's felt the patient's condition warranted additional consultation or transfer to a higher level of care. This action was bolstered by collective agreement to escalate among senior nurses.

> I think probably the nurse waits a little bit longer than they're comfortable with cause they're going to give the doctor the benefit of the doubt. If the patient is okay, but then ultimately if things don't get better they're going to call for RRT. Which can be uncomfortable to go and do something that the doctor doesn't want you to do, but we would do it. RN_04

> So, say you've gone to your charge nurse, and some other senior nurses are backing you up, and everybody's like, "We need to call, we need to call RRT...nurses together, collaborate and give their opinion, and their experience…the nurses feel compelled to say, "I'm sorry. I'm doing this, I'm calling RRT. RN_03

Consequences

Organizational resiliency evidenced by an esprit de corps, flexible staffing, and opportunities for contingency planning created situation awareness of potential risk situations and consensus in setting goals for surveillance. Adequate supplies, equipment, and staffing, and processes that promoted team performance facilitated nurses with the requisite skill, knowledge and experience to manage deterioration.

> Typically, as the charge nurse too, we talk about this at the charge-charge report, and also, we do this as the management team with the charge nurse, if there's anyone in the unit that they are concerned about, patients that are on a high-risk medication, any events overnight that might be concerning. We always talk about not just the patients that are sick on the floor, but patients that they are...like the watchers. Typically, we would say, "Who are you concerned about? Who are the watchers? RN_05

> And so do I think that we're all really supportive of each other and when that Staff Assist light goes off, we still do our best to support staff, support our coworkers, that culture? That culture exists. The concept of nobody's going to, we're not going to let anybody drown, if we know that they're drowning. RN_09

Nursing surveillance actions aimed to identify patients at risk, match the level of surveillance to patient risk, prepare the environment so that instability could be managed, and expedite transfer if the patient's care requirements surpassed the resources available in the acute care setting. In many instances instability was curtailed by early intervention. In other situations instability was identified and treated until the patient progressed to deterioration at which point the patient was ultimately transferred to the ICU.

Conflicts arose between floor and ICU nurses when a patient was identified as requiring a higher level of care. Nurses in the ICU pushed back and questioned the need for transfer when capacity in the ICU was limited or if it appeared instability could be managed with brief durations of interventions or more frequent monitoring that could be accommodated on the acute care floor. Disagreements between acute care nurses and physicians resulted from differences in opinions about whether to call a RRT, and about the acuity and available resources to care for the patient. In these situations nurses would base their appeal for transfer on the lack of supplies, equipment and staff to adequately care for the deteriorating patient while additionally caring effectively for the other patients on the floor.

> There can also be um, some tension between the ICU nurses and the floor nurses. Um, and often that is exacerbated by staffing, and they're, they're short staffed or busy, then these things flare up a little bit more I think sometimes. RN_03

> There definitely can be disagreements about what's right for the patient, what's appropriate for the floor, and when care needs to be escalated. And there's been some situations where the doctors are pretty aggressive with the nurses because they think everything's fine but then nurses are uncomfortable taking care of the patient in that situation. RN_04

Conflicts arose between parents and nurses about how and when nurse's completed their assessments, administered ordered treatments, and when the patient's care exceeded the

resources of the acute care floor. These conflicts, at times, resulted in delays in assessments, treatments, and transfers to environments with supplies, equipment, and experienced clinicians to manage a critically ill patient.

> We had a very memorable one [parent] not too long ago that would prevent nursing staff from doing assessments as frequently as we needed to. Because they wanted the child [to rest], and I understand rest is really difficult to get in a hospital, and we can do a better job of clustering care so we're not disturbing patients as often…We weren't even able to do as frequent vital signs as we needed to do, even as his condition was starting to be concerning. RN_08

> I know some families, particularly like, some of the BMT [blood and marrow transplant] families are on the unit for a very long time, they don't particularly want to go to the ICU, even though their kid might be decompensating rapidly. So I have heard and seen families say that they don't want to go to the ICU. But nursing doesn't really give them that option, or we do our best to explain why they need to go to the ICU. RN_01

To resolve conflicts nurses escalated concerns initially to their charge nurse. Nurses would refer to policy to settle disagreements over whether a patient could be cared for on the acute care floor. If unresolved, nurses would request assistance from administrative and clinical leaders to settle disputes.

> I have before, I try not to. I mean it just kind of depends on what the situation is. But I have called the attending in the past. To put in orders, or ask them questions. RN_01

> But if they're requiring ...we're being asked to do neuro checks more than we're really allowed to do in our policy. If we're supposed to do vital signs for more frequent, other than for a defined period of time, like for a medication or something. If we're supposed to be doing certain monitoring things more often than we're allowed to, or the minute a doctor said we have to put them on the cardiac monitor for cardiac monitoring purposes, we're not allowed to do that on my unit. Or certain medications, we're not allowed to do on my unit either. So, if they're requiring those medications, they would need to go to the ICU. If they're requiring one to one nursing, they would go to the ICU because we cannot provide that. Things like that. So really policy based. RN_12

Discussion

We set out to explore the facilitators and barriers to nursing surveillance and define nursing activities during surveillance. We found that nurses engage in 6 key activities: establishing a baseline, anticipating risk, noticing, evaluating, managing, and escalating. Each of these activities were impacted by individual and system based factors which either inhibited or

facilitated nursing surveillance. We found that the safety culture of the nursing unit, as well as conditions of unit resilience in terms of resources, nursing knowledge and experience, availability of equipment and supplies, family presence, and systems for managing clinical data and for calling for help also influenced nursing surveillance.

There were no instances, per nursing participants, wherein instability was not recognized or treated. These findings are different than what has been previously reported (Hayes et al., 2012; Pearson, 2008; Tume, 2007). This may be a result of nurse participant recall bias or framing of interview questions, however; participants provided scenarios of conditions they attributed to decreasing their ability to recognize patient changes or institute restorative treatments, situations similar to those reported by other researchers (Brady & Goldenhar, 2014; Gawronski et al., 2018).

Retrospective reviews of patient deterioration events suggest that a lack of documentation of intervention or assessment indicates clinicians were either not aware or did not act to ameliorate instability (Franklin & Mathew, 1994; Goldhill, White, & Sumner, 1999). The findings in this study point to a number of interactional and environmental factors that impede clinician's ability to recognize and treat instability. This study is the first to specify what pediatric nurses do during surveillance, which highlights a number of likely undocumented activities such as repeated assessments, measures increase observation, obtaining confirmation of instability, intermittent trials of symptom management, and escalation.

Findings in this study are similar to others which have looked at interpersonal, cultural environmental, and system factors that influence patient care, specifically communication between clinicians, teamwork, and safety culture (Brady & Goldenhar, 2014; Gawronski et al., 2018). This study however highlights nuances about handover, availability of resources, and

systems for calling for help that extend what is currently known, and can be useful for improving surveillance processes. Contingency planning was highlighted as an important strategy for increasing situation awareness and preparing treatment plans for potential instability in this study as has been reported by others (Brady, et al., 2013). Performance shortcomings of the PEWS for reliable recognition of patient instability in complex chronically ill patients, and system problems with PEWS adoption were findings as in other studies (Bonafide, et al., 2013).

Three activities of nursing surveillance warrant further discussion. In some cases of nurse accounts of noticing a change in patient condition were based on assessments attributed to sensory inputs, cognitive activities, and intuition. This description is consistent with the concept of clinical grasp described by Benner, Kyriakidis, and Stannard (2011). The addition of managing and escalating to the continuum of action associated with surveillance is a novel construction. Nurses included escalation and short trials of interventions as activities closely associated with re-assessment, interpretation, synthesis and decision making of an evolving situation of clinical instability. In some cases, more intense surveillance was an intervention and has been associated with improved patient outcomes (Kutney-Lee, Lake, & Aiken, 2009; Shever, 2011). Intervention has also been included in other discussions of nursing surveillance (Henneman, Gawlinski, & Guiliano, 2012; Kelly & Vincent, 2011; Kutney-Lee, Lake, & Aiken; 2009).

Limitations

Data gathered through retrospective accounts of clinical situations may result in bias, either because of lapses in memory of event details or because respondents only know which data are important once an event has occurred. A sample of 13 nurses, and at one site, could potentially limit transferability of findings, though findings are commensurate with other similar studies with nursing caring for pediatric and adult patients. Also participants worked at an

academic institution with clinical resources that may be dissimilar to community settings. We interviewed nurses with at least 1 year of experience. This was an inclusion criteria based on the assumption that within 1 year nurses would have a sufficient range of experiences to draw from to respond to interview questions. This assumption proved to be realized, but it remains unclear whether newer nurses would have similar or different experiences that further inform the research aims.

Clinical and Research Implications

The results of this study add confirmation to the assertion that improving recognition and intervention for patients at risk for deterioration requires a multipronged approach; an approach that bolsters not only individual clinician's skill, knowledge, and teamwork, but also addresses system factors such as interdisciplinary communication and proactive care planning. A number of factors have been identified which can be incorporated into a program for improvement. We have described the specific nursing actions that occur during nursing surveillance and factors that inhibit or enhance those actions. Nursing leaders can use this information to improve allocation of resources and as a basis for strategizing with physician leaders to improve unit safety culture.

There are 3 areas of further research that could add to our understanding of how to improve nursing surveillance of pediatric patients. The first is a better understanding of nursing surveillance from the perspective of physician colleagues. Such inquires could include how nurse/physician interaction impacts situation awareness of patient condition and what factors impact decision making by physicians to treat on the unit or transfer to the ICU. A second area of study is to better understand the process of contingency planning such as the facilitators and barriers to contingency planning, when it occurs, with whom, and how it is structured. This would assist in developing best practices for planning.

Conclusions

We have shown that maintaining perspective on managing stability within a sociotechnical system is influenced by a number of individual characteristics, interactions among various clinicians, and system processes aimed at managing clinical data and marshalling resources. Parents were identified as an influential partner in instability recognition and summoning attention for evaluation and intervention. The study extended our knowledge about nursing activities during surveillance, and facilitators and barriers to each aspect of nursing surveillance.

Table 3.1
Nurse Interview Guide

	Questions
1.	Tell me about your experience with pediatrics patients?
2.	What kinds of patients do you work with?
3.	I imagine during your time caring for patients there have been occasions when you helped prevent them from becoming unstable. Tell me about a time in which your patient experienced a change in condition and you remember it as a good save; a time you felt you influenced the outcome of your patient.
4.	I am interested in knowing about a time when you were really worried about your patient's condition because it looked like it was going to get much worse; someone you felt you had to watch very carefully. Tell me about that experience.
5.	Tell me about a time when a patient deteriorated who did not recover or who was transferred. Can you walk me through that?
6.	What worked well in that situation? What was difficult? Can you tell me how you recognized any changes in the patient's condition?
7.	Where was the family when this was happening? What was their role in the situation?
8.	Do you have any thoughts about how culture such as work environment and relationships might influence the safety of patients in these situations?
9.	Is there anything else you would like to tell me about? What haven't I asked you about that I should have?

Table 3.2
Characteristics of Nurse Participants

Nurse Characteristics (n = 13)	
Gender	12 (92%) female
Age years; median (range)	34 (25-58)
Race	
White	7 (54%)
Asian	6 (46%)
Education	
Undergraduate studies (BSN)	7 (54%)
Graduate studies (MSN)	6 (46%)
Years in Pediatrics years; median (range)	10 (2-18)

Table 3.3
Explanatory Matrix

Perspective: maintaining perspective on patient stability within a socio-technical system

Context	Conditions	Processes	Consequences
Safety culture	Unit resilience ▪ Patient assignments ▪ Resources Nurse knowledge and experience Equipment and Supplies Systems for managing clinical data Systems for calling for help Family presence	Establishing a baseline Anticipating risk Noticing Evaluating Managing Escalating	Consensus on goals for surveillance Early recognition and management of deterioration Failures in recognition Delays in treatment Conflicts

References

Aiken, L. H., Clarke, S. P., & Sloane, D. M. (2002). Hospital staffing, organization, and quality of care: Cross-national findings. *Nursing Outlook, 50*(5), 187-94. https://doi.org/10.1067/mno.2002.126696

Andrews, T., & Waterman, H. (2005). Packaging: A grounded theory of how to report physiological deterioration effectively. *Journal of Advanced Nursing, 52*(5), 473-481. https://doi.org/10.1111/j.1365-2648.2005.03615.x

Astroth, K. S., Woith, W. M., Stapleton, S. J., Degitz, J., & Jenkins, S. H. (2013). Qualitative exploration of nurses' decisions to activate rapid response teams. *Journal of Clinical Nursing, 22*(19-20), 2876-2882. https://doi.org/10.1111/jocn.12067

Azzopardi, P., Kinney, S., Moulden, A., & Tibballs, J. (2011). Attitudes and barriers to a medical emergency team system at a tertiary paediatric hospital. *Resuscitation, 82*(2), 167-174. https://doi.org/10.1016/j.resuscitation.2010.10.013

Benner, P.E., Hooper-Kyriakidis, P.L, & Stannard, D. (2012). *Clinical Wisdom and Interventions in Acute and Critical Care: a Thinking-In-Action Approach* (2nd ed.) New York: Springer.

Bonafide, C. P., Roberts, K. E., Priestly, M. A., Tibbetts, K. M., Huang, E., Nadkarni, V. M., & Keren, R. (2012). Development of a pragmatic measure for evaluating and optimizing rapid response systems. *Pediatrics, 129*(4), e874-e881. https://doi.org/10.1542/peds.2011-2784.

Brady, P. W., & Goldenhar, L. M. (2014). A qualitative study examining the influences on situation awareness and the identification, mitigation and escalation of recognised patient risk. *BMJ Quality & Safety, 23*(2), 153-161. https://doi.org/10.1136/bmjqs-2012-001747

Brady, P. W., Muething, S., Kotagal, U., Ashby, M., Gallagher, R., Hall, D.,…Wheeler, D. S. (2013). Improving situation awareness to reduce unrecognized clinical deterioration and serious safety events. *Pediatrics, 131*(1), e298-e308. https://doi.org/10.1542/peds.2012-1364

Bulechek, G. M., Butcher, H., Dochterman, J. M., & Wagner, C. M. (2013). *Nursing interventions classification (NIC;* 6th ed.). St. Louis, MO: Elsevier.

Cioffi, J. (2000a). Recognition of patients who require emergency assistance: a descriptive study. *Heart and Lung*, *29*(4), 262-268. https://doi.org/10.1067/mhl.2000.108327

Cioffi J. (2000b). Nurses' experiences of making decisions to call emergency assistance to their patients. *Journal of Advanced Nursing*, *32*(1), 108-114. https://doi.org/10.1046/j.1365-2648.2000.01414x

Cox, H., James, J., & Hunt, J. (2006). The experiences of trained nurses caring for critically ill patients within a general ward setting. *Intensive and Critical Care Nursing*, *22*(5), 283-293. https://doi.org/10.1016/j.iccn.2006.02.003

Cutler, L. R. (2002). From ward-based critical care to educational curriculum 2: a focused ethnographic case study. *Intensive and Critical Care Nursing*, *18*(5), 280-291. https://doi.org/10.1016/S0964339702000319

DeVita, M. A., Smith, G. A., Adam, S. K., Adams-Pizarro, I., Buist, M., Bellomo, R.,…Winters, B. (2010). Identifying the hospitalized patient in crisis – A consensus conference on the afferent limb of rapid response systems. *Resuscitation, 81*(4), 375-382. https://doi.org/10.1016/j.resuscitation.2009.12.008

Gazarian, P. K., Henneman, E. A., & Chandler, G. E. (2010). Nurse decision making in the prearrest period. *Clinical Nursing Research, 19*(1), 21-37. https://doi.org/10.177/1054773809353161

Gawronski, O., Parshuran, C., Cecchetti, C., Tiozzo, E., Coife degli Atti, M.L., Dall-Oglio, I., Scarselletta, G.,...Latour, J.M. (2018). Qualitative study exploring factors influencing escalation of care of deteriorating children in a children's hospital. *BMJ Paediatrics Open, 2*(1), e000241. httsp://doi.org/10.1136/bmjpo-2017-000241.

Goldhill, D. R, White, S. A, & Sumner, A. (1999). Physiological values and procedures in the 24 h before ICU admission from the ward. *Anaesthesia, 54*(6), 529-534. https://doi.org/10.1046/j.1365-2044.1999.00837.x

Hanson, C. C. Randolph, G. D., Erickson, J. A., Mayer, C. M., Bruckel, J. T., Harris, B. D., & Willis, T. S. (2010). A reduction in cardiac arrests and duration of clinical instability after implementation of a paediatric rapid response system. *Postgraduate Medical Journal, 86*(1015), 314-318. https://doi.org/10.1136/qshc.2007.026054

Hayes, L. W., Dobyns, E. L., DiGiovine, B., Brown, A. M., Jacobson, S., Randall, K. H.,…Markovitz, B. (2012). A multicenter collaborative approach to reducing pediatric codes outside the ICU. *Pediatrics, 129*(3), e785-e791. https://doi.org/10.1542/peds.2011-0227

Henneman, E. A., Gawlinski, A., & Giuliano, K. K. (2012). Surveillance: A strategy for improving patient safety in acute and critical care units. *Critical Care Nurse, 32*(2), e9-e18. https://doi.org/10.4037/ccn2012166

Hickey, P. A., Gauvreau, K., Curley, M. A., & Connor, J. A. (2013). The effect of critical care nursing and organizational characteristics on pediatric cardiac surgery mortality in the United States. Journal of Nursing Administration, 43(12), 637-644. https://doi.org/10.1097/NNA.0000000000000005

Joffe, A. R., Anton, N. R., & Burkholder, S. C. (2011). Reduction in hospital mortality over time in a hospital without a pediatric medical emergency team: Limitations of before-and-after study designs. *Archives of Pediatric and Adolescent Medicine, 165*(5), 419-423. https://doi.org/10.1001/archpediatrics,2011.47

Jones, D., Mitchell, I., Hillman, K., & Story, D. (2013). Defining clinical deterioration. *Resuscitation, 84*(8), 1029-1034. https://doi.org/10.1016/j.resiscitation.2013.01.013

Kelly, L., & Vincent, D. (2011). The dimensions of nursing surveillance: A conceptual analysis. *Journal of Advanced Nursing, 67*(3), 652-661. https://doi.org/10.1111/j.1365-2648.2010.05525.x

Kenward, G., & Hodgetts, T. (2002). Nurse concern: a predictor of patient deterioration. *Nursing Times, 98*(22), 38-39.

Krapohl, G., Manojlovich, M., Redman, R., & Zhang, L. (2010). Nursing specialty certification and nursing-sensitive patient outcomes in the intensive care unit. *American Journal of Critical Care, 19*(6), 490-498. https://doi.org/10.4037/ajcc2010406

Kutney-Lee, A., Lake, E .T., & Aiken, L .H. (2009). Development of the hospital nurse surveillance capacity profile. *Research in Nursing & Health, 32*(2), 217-228. https://doi.org/10.1002/nur.20316

Kyriascos, U. (2011). Monitoring vital signs using early warning scoring systems: A review of the literature. *Journal of Nursing Management, 19*(3), 311-330. https://doi.org/10.1111/j.1365-2834.2011.01246.x

Lambert, V., Matthews, A., MacDonell, R., & Fitzsimons, J. (2017). Paediatric early warning systems for detecting and responding to clinical deterioration in children: A systematic review. *BMJ Open,* 7(3), e014497. https://doi.org/10.1136/bmjopen-2016-014497

McCurdy, M. T., & Wood, S. M. (2012). Rapid response systems: Identification and management of the "prearrest state". *Emergency Medicine Clinics of North America, 30*(1), 141-152. https://doi.org/10.1016/j.emc.2011.09.012

McNeill, G., & Bryden, D. (2013). Do either early warning systems or emergency response teams improve hospital patient survival? A systematic review. *Resuscitation, 84*(12), 1652-1667. https://doi.org/10.1016/j.resuscitation.2013.08.006

Meyer, G. A., Lavin, M. A., & Perry, A. G. (2007). Is it time for a new category of nursing diagnosis? *International Journal of Nursing Terminologies and Classifications, 18*(2), 45-50. https://doi.org/10.1111/j.1744-618X.2007.00049.x

Minick, P., & Harvey, S. (2003). The early recognition of patient problems among medical surgical nurses. *MedSurg Nursing, 12*(5), 291- 297.

O'Leary, F., McGarvey, K., Christoff, A., Major, J., Lockie, F., Chayen, G.,…Wharton, S. (2014). Identifying incidents of suboptimal care during pediatric emergencies – an observational study utilising in situ simulation centre scenarios. *Resuscitation, 85*(3), 431-436. https://doi.org/10.1016/j.resiscitation.2013.12.001

Parshuram, C. S., Dryden-Palmer, K., Farrell, C., Gottesman, R., Gray, M., Hutchinson, J. S.,…Tomlinson, G. A. (2018). Effect of a pediatric early warning system on all-cause mortality in hospitalized pediatric patients. The EPOCH Randomized Clinical Trial. *JAMA, 319*(10), 1002-1012. https://doi.org/10.1001/jama.2018.0948

Pearson, G. (Ed.). (2008). *Why Children Die: A Pilot Study 2006*; England (South West, North East and West Midlands), Wales and Northern Ireland. London: Confidential Enquiry into Maternal and Child Health (CEMACH).

Pollack, M. M., Cuerdon, T. C., Patel, K. M., Ruttiman, U. E., Geston, P. R., & Levetown, M. (1994). Impact of quality-of-care factors on pediatric intensive care unit mortality. *JAMA, 272*(12), 941-946. https://doi.org/10.1001/jama.1994.03520120051030

Power, N., & Franck, L. (2008). Parent participation in the care of hospitalized children: A systematic review. *Journal of Advanced Nursing, 62*(6), 622-641. https://doi.org/10.1111/j.1365-2648.2008.04643.x

Profit, J., Petersen, L. A., McCormick, M. C., Escobar, G. J., Coleman-Phox, K., Zheng, Z., Pietz, K., Zupancic, J. A. (2010). Patient-nurse ratios and outcomes of moderately preterm infants. *Pediatrics, 125*(2), 320-326. https://doi.org/10.1542/peds.2008-3140

Reis, A. G., Nadkarni, V., Perondi, M. B., Grisi, S., & Berg, R. A. (2002). A prospective investigation into the epidemiology of in-hospital pediatric cardiopulmonary resuscitation using the international Utstein reporting style. *Pediatrics, 109*(2), 200-209. https://doi.org/ 10.1542/peds.109.2.200

Robb, G., & Seddon, M. (2010). A multi-faceted approach to the physiologically unstable patient. *Quality & Safety in Healthcare, 19*(5), e47. https://doi.org/10.1136/qshc.2008.031807

Shearer, B., Marshall, S., Buist, M. D., Finnigan, M., Kitto, S., Hore, T.,…Ramsay, W. (2012). What stops hospital clinical staff from following protocols? An analysis of the incidence and factors behind the failure of bedside clinical staff to activate the rapid response system in a multi-campus Australian metropolitan healthcare service. *BMJ Quality & Safety, 21*(7), 569-575. https://doi.org/10.1136/bmjqs-2011-000692

Taenzer, A. H., Pyke, J. B., McGrath, S. P., & Blike, G. T. (2010). Impact of pulse oximetry surveillance on rescue events and intensive care unit transfers. *Anesthesiology, 112*(2), 282-287. https://doi.org/10.1097/ALN.0b013e3181ca7a9b

Tibby, S. M., Correa-West, J., Durward, A., Ferguson, L., & Murdoch, I. A. (2004). Adverse events in a pediatric intensive care unit: relationship to workload, skill mix and staff supervision. *Intensive Care Medicine, 30*(6), 1160-1166. https://doi.org/10.1007/s00134-004-2256-y

Tume, L. (2007). The deterioration of children in ward areas in a specialist children's hospital. *Nursing in Critical Care, 12*(1), 12-19. https://doi.org/10.1111/j.1478-5153.2006.00195.x

Van Loon, K., Van Zaane, B., Bosch, E .J., Kalkman, C. J., & Peelen, L. M. (2015). Non-invasive continuous respiratory monitoring on general hospital wards: a systematic review. *Plos One, 10,* e0144626. https://doi.org/10.1371/journal.pone.0144626.

Voepel-Lewis, T., Pechlavanidis, E., Burke, C., & Talsma, A. N. (2013). Nursing surveillance moderates the relationship between staffing levels and pediatric postoperative serious adverse events: A nested case-control study. *International Journal of Nursing Studies, 50*(7), 905-913. https://doi.org/10.1016/j.ijnurstu.2012.11.014

Watson, A., Skipper, C., Steury, R., Walsh, H., & Levin, A. (2014). Inpatient nursing care and early warning scores: A workflow mismatch. *Journal of Nursing Care Quality, 29*(3), 215-222. https://doi.org/10.1097/NCQ.0000000000000058

Wheatley, I. (2006). The nursing practice of taking level 1 patient observations. *Intensive and Critical Care Nursing*, *22*(2), 115-121. https://doi.org/10.1016/j.iccn.2005.08.003

CHAPTER FOUR

PARENTS' AND NURSES' PERSPECTIVES ON INTEGRATING THEIR ROLES IN SURVEILLANCE OF HOSPITALIZED CHILDREN IN NON INTENSIVE CARE UNIT ENVIRONMENTS[3]

JAMES R. STOTTS

[3] Manuscript to be submitted to *BMJ Quality & Safety*…….

Abstract

Background

Strategies to improve early identification and management of deterioration in hospitalized pediatric patients focus mainly on nurse education, early warning trigger tools and emergency response systems. Though partnership of parents in care delivery and parent roles in safety improvement have been studied, their collaboration with nurses in the surveillance of deterioration has not. The purpose of this study was to describe nurses' and parents' perspectives on how they integrate their roles in surveillance, and identify factors that may influence integration and surveillance efficacy in acute care pediatric settings.

Methods

Semi-structured interviews, naturalistic observations, and review of written materials were conducted with parents of hospitalized pediatric patients (N=16) and nurses working on acute care pediatric units (N=13). The qualitative investigation was based on grounded theory using situational and dimensional analysis techniques.

Results

Parents described surveillance as watching over condition changes, the safety and comfort of their child, as well as practices of clinical staff. Integration of the roles of nurses and parents during surveillance required both to adapt to each other's stress and coping behaviors, social norms, routines, and expectations; negotiate care of the patient; and collaborate on decision making and management of condition changes. When integration went well parents and nurses worked together to identify and manage patient changes. Conflicts caused delays in assessment and concerns for delays in or missed treatments.

Conclusions

A model for explaining the independent and interdependent processes that occur between parents and nurses during patient surveillance of condition changes was described that can be used to facilitate improved partnerships, improve surveillance, and manage role conflicts between parents and nurses.

Introduction

Failures in recognition and management of in-hospital pediatric instability are associated with increased adverse outcomes and healthcare related costs (Miller, Elixhauser & Zhan, 2003; Tibballs, Kinney, Duke, Oakley & Hennessy, 2005, Duncan, Hutchinson, & Parshuran, 2006, Haines, Perrott, & Weir, 2006; McCabe, Duncan, & Heward, 2009). Early detection of concerning patient changes is recognized as a primary determinant of successful treatment, recovery, and avoidance of deterioration (Haines, Perrott, & Weir, 2006; Tume, 2007; Pearson, 2008). Though reported harm rates in hospitalized children are low (0.78/1000 discharge for cardiopulmonary arrest; 19.1 per 1000 patient days for adverse events) (Martinez & Totapally, 2016; Stockwell et al., 2018), events requiring rescue such as reversible deterioration or complications occur in as many as 19% of patients (Bonafide et al., 2012; Brilli et al., 2007; Kotsakis et al., 2011; Sedman et al., 2005; Slonim, Lafleur, Ahmed, & Josheph, 2003; Tume, 2007; Zenker et al., 2007).

Because of their near continuous interaction with pediatric patients, both parents and nurses are likely to quickly identify risk of clinical deterioration and observe changes in patient condition that warrant intervention. Engaging families in adverse event surveillance and mitigation through reporting events (Daniels et al., 2012; Frey et al., 2009; Khan et al., 2017), and in speaking-up (AHRQ, 2017; The Joint Commission, 2018) are promoted as useful and effective strategies to improve patient safety. Families are recognized as important adjuncts in surveillance of clinical instability by establishing baseline patient assessment characteristics, identifying alterations in patient condition, escalating patient concerns, and in facilitating situation awareness of impending patient deterioration (Bavare, Thomas, Elliott, Morgan, & Graf, 2017; Brady & Goldenhar, 2014; Brady et al., 2015; Paciotti et al., 2014). Parents identify their role as guardians and advocates for their child's care needs (Rosenberg, 2016). They

perceive their presence as a means to assure continuity of care, individualize attention, identify potential problems, and to monitor for omissions in care (Cox et al., 2017; Dudley & Carr, 2004; Hurst, 2001; Ygge & Arnetz, 2004).

Surveillance is the most prevalent nursing activity for hospitalized patients (Shever, Titler, Dochterman, Fei, & Picone, 2007). It encompasses the purposeful and continuous acquisition, interpretation, and synthesis of patient data for the purpose of determining health and safety threats and the need for intervention (Bulechek, Butcher, Dochterman, & Wagner, 2013; Meyer, Lavin, & Perry, 2007; Kelly & Vincent, 2011). Efforts to assist nurses in surveillance of deterioration consists of the implementation of pediatric early warning systems, objective criteria for calling rapid response systems, and skill building for early recognition and management of clinical instability (Brilli et al., 2007; Duncan, Hutchison, & Parshuram, 2006; Tume, Sefton, & Arrowsmith, 2013).

There is, however; limited data that describes the interactions between parents and nurses in the surveillance of hospitalized children. Earlier studies focused on how nurses and parents defined and negotiated their 'partnership' in providing care. Findings emphasized the importance of clarifying roles and expectations for care responsibilities (basic and technical nursing tasks) and for establishing trust through getting to know the child, and developing rapport with the parents (Espezel & Canam, 2003; Coyne & Cowley, 2007). References to surveillance activities suggested incongruent perspectives. Parents maintained vigilance in monitoring their child and staff activities, and felt underutilized as a resource about their child's care and a partner in decision making (Coyne & Cowley, 2007; Espezel & Canam, 2003; Roden 2005; Ygge & Arnetz, 2004). Nurses expected parents to engage in basic care (e.g., feeding,

dressing, toileting, and bathing) but had concerns about accountability over nursing tasks rendered by parents (Blower & Morgan, 2000).

Recent studies indicate that parent's ability to collaborate in safety assurance is dependent in part on clinician attitudes and personal interactions with parents. Bsharat and Drach-Zahavy (2017) found a nurse's willingness to work with a parent to resolve a safety concern was influenced by attributes the nurse ascribed to the parent's behavior. Nurses were less willing to assist the parent if they considered the nature of the concern to be within the parent's control, or of minor significance. Clinician reactions and responses to parent involvement in patient safety also attenuates engagement in surveillance. For instance, studies have shown that parents are more likely to participate if their input is acknowledged and valued, and does not result in negative repercussions for the clinician, retribution against the parents or their child, or in any way damage parent/nurse working relations (Lyndon, Wisner, Holschuh, Fagan & Franck, 2017; Rosenberg et al, 2016; Sawhney, Davis, Daraiseh, Belle, & Walsh, 2017).

Given the lack of empirical data to guide strategies for facilitating collaboration between nurses and parents in executing surveillance, the aim of our exploratory study was to describe nurses' and parents' perspectives on how they integrate their roles in surveillance, and identify factors that may influence integration and thus surveillance efficacy in acute care pediatric settings.

Methods

The methods for this study were described in detail in Chapter 3 with the exception for methods in recruiting parents. Recruitment of parents is described in detail followed by an abbreviated review of methodology.

Purposive sampling was initially used to recruit both nurse and parent participants. Parents were recruited from those visiting children admitted to study units based on nurse referral. Parents were English speaking and willing to talk about their hospital experiences. Parents of patients admitted within the previous 48 hours or who were emotionally upset were excluded. One researcher enrolled participants (JRS). This was done following review of the research protocol and after informed content was given. For participation in the study, a $20 gift card was given as a token of appreciation.

The study used grounded theory as a qualitative methodology because the study aims intended to explore actions and interactions of parents and nurses within the context of patient surveillance on acute care pediatric wards.

Parent and nurse data were collected between June 2018 and January 2019 by one researcher (JRS) through individual interviews and observations of parent, children, and clinician interactions during interview sessions. Semi-structured/open-ended questions designed to explore perceptions about family impact on nursing surveillance guided parent and nurse interviews (Table 4.1, 4.2). Parent interviews occurred in patient rooms or privately in designated family lounges. Verbal consent for observation was obtained by all healthcare workers and parents involved in observation experiences. Data collection was guided by grounded theory principles of data saturation and theoretical sampling. Methods for data management met institutional review board criteria for confidentiality and data anonymity.

Data analysis occurred iteratively and concurrently with data collection (Glaser and Strauss, 1967). As data were translated into codes; constant comparison, memoing, situational analysis, dimensional analysis, and theoretical sampling aided in developing properties and

dimensions of codes into concepts and theory. Memoing was also used to think reflexively about the researcher's impact on study procedures. (Charmaz, 2014).

Researcher positionality was evaluated through peer checking and memoing. Data trustworthiness was enhanced by using multiple sources of data. Developing analyses of data were shared with a group of qualitative researchers for ongoing feedback and expert review. The quality of data synthesis was evaluated through ongoing member checking during successive interviews, triangulation and reflection.

Results

Thirteen nurses and 16 parents (representing 14 children) enrolled in the study. Four nurses (1 charge nurse, 3 bedside nurses) were observed during clinical work for a total of 8 hours of shadow observation. Twelve parents were interviewed individually; four participants were interviewed as couples. Participant characteristics are displayed in Table 4.3.

Initially parents interpreted questions asking about nursing surveillance and deterioration as solicitations of negative and positive feedback about nursing behaviors. Consequently early responses from parents consisted of praises about the professionalism and expertise of the nursing staff. As rapport developed, questions were clarified, and with repeated assurances of confidentiality, parents relayed a fuller description of experiences with monitoring patients for condition changes.

The proceeding discussion describes results using a central perspective of *parents and nurses integrating their respective roles in patient surveillance* of hospitalized children as a frame of reference (Table 4.4). Though providers and patients are typically integral to any discussion of patient care, for purposes of this study they were silent actors. Therefore findings will be discussed from the parent and nurse perspectives only.

Paramount to parents' perspectives was an overarching sense of duty to advocate for the safety and needs of their child and maintain autonomy in decision making. Parents portrayed surveillance as watching over and coordinating the care their child received from others and integrating responsibilities for care with nurses. These activities were shaped by parents' ability to cope with uncertainty and the social norms of a hospital environment. Parents described their role in all aspects of surveillance: data acquisition, interpretation, synthesis, and decision making about interventions and threats to safety. However, parents consistently discussed the object of surveillance as not just to identify and treat condition changes, but to monitor the well-being, comfort, and safety of their child, and care practices of clinical staff. Parent accounts of surveillance activities included accounts of recognizing changes in signs and symptoms and working with nursing staff to determine further actions, as well as examples of vigilance in preventing errors and coordinating efforts of nurses and physicians.

The main perspective of nurses was that of accountability: accountability for executing the plan of care, maintaining patient safety, ensuring validity in assessments and documentation, and upholding hospital and unit standards. Nurses unanimously acknowledged the importance of parent participation in surveillance especially data acquisition by contributing baseline information and assisting in the evaluation of patient responses. The confluence of these different perspectives (nurse accountability with parent advocacy and autonomy) during care delivery required accommodations by both parents and nurses in order to achieve an optimal balance between priorities of care and role satisfaction.

Situation Context: Convergence of Social Norms

Parents and nurses found themselves having to learn and adapt to the norms of each other's social environments. Many parents came with care routines already established in the

home that they anticipated continuing while in the hospital. Parents wanted varying levels of involvement in providing care to their child in order to maintain continuity and attenuate their child's stress of hospitalization. Parents also wanted a say in care treatment decisions including what procedures where done and how they were orchestrated. There were occasions when parents would ask nurses to do treatments a certain way or change the treatment time so as not to disturb their child, to accommodate the parents' or child's routine, or to minimize the child's reaction to treatment.

In contrast hospital routines were both regimented and chaotic, with care provided around the clock. Shift change, meal times, scheduling of medications and treatments, and rounding were mostly predictable; however meetings with specialists, plans for tests and procedures, and decisions about disposition were often fluid. For some parents the change in routine and uncertainty was difficult to cope with sometimes resulting in parent frustration and attempts to control the situation.

> Nurses would be ready to NPO him for procedure that wasn't actually going to happen. It would be, the doctor would propose a time. And we would all talk about it. So it was tentatively, it will be on this date to do whatever, MRI, Pet Scan or whatever it was...but that procedure had moved two days, or it had dropped off, and they were going to discuss it. There was, like a breakdown in communication... Family_06

> Another heaviness [in patient assignment] is parents who are very specific about the care. Very specific about everything so there's a little bit more family dynamics going on, sometimes very difficult for the nurses to do what they need to do in the room. I think those parents are, I don't think that they wouldn't call us if a condition changes. It's more like, I need my bath at this specific time only and...it's probably because they're super worried and they're super anxious and it may be harder for them to have control of this situation, this is the way they take control. So I see it as a whole different thing. And I say, "What do you need, tell me what you need. RN_06

Parents' willingness to speak up about issues such as errors, differences in practice, or potential problems was influenced by their beliefs about their role as an advocate, their extent of medical knowledge, and their beliefs and experiences about interactions with the medical community. In one situation a parent suspected her daughter's diarrhea was due to a medication

she was prescribed but was reluctant to mention it to her nurse or physician. Another parent relays her experiences when trying to coach nurses about her son's disease.

> Cause I mean, I was thinking and I was afraid to tell them because, you know, I'm not a doctor, I don't know anything. And that's what many of us are afraid, that we, you know we don't know anything, you know? We don't know what's going to be best for her. We're counting on them, that they, they're doing the right thing. Yeah so I was a little afraid to say that, you know? Family_09

> It's hard in our situation where nurses aren't as familiar with rare conditions, and so they think that when I'm bringing something up as a change or a possibility or something I might be noticing and in their eyes it's normal. And so it's kind of, kind of being dismissed in a way...That gets in the way. Like, when a nurse is, like, kind of closed off and set in their ways and not willing to kind of think about possibilities... Family_04

This contrasts with the comments made by other parents who had developed coping strategies to deal with the hierarchy of the hospital social environment.

> But I've learned to say, "No, I don't want it that way," or, "I think this way's better." It's all about having to be able to speak for your child because they can't do it themselves. Without our input, there's not much that can be done." Family_16

> "I didn't have a problem speaking up here. I probably did in the past because there's a power dynamic, at play, between a patient and a doctor. I think if you don't recognize that you have power, too, and you have rights, then it can be an intimidating experience." Family_14

Nurses expressed that they embraced patient and family centered care, which meant encouraging parent engagement, and learning and incorporating parent and child routines of daily living and treatment schedules. Nurses however felt responsible for providing some aspects of patient care, especially those that afforded an opportunity for evaluating the patient's condition (e.g. evaluating the appearance of a wound, the color of urine) and responses to treatment. Nurses expressed concern when they were prevented from following hospital or unit standards or physician orders that dictated how and when to provide care. They felt obligated to complete certain tasks within an expected timeframe and to be physically present for specific aspects of care so that assessments could be documented based on personal experience. Parents

and nurses had to learn each other's expectations and perceptions of responsibility for care delivery to accommodate and satisfy both needs.

> We do vitals every four hours as a standard...[Parents would say] "She just fell asleep, could you wait to do vitals?" And then you're waiting and it's six hours. And if the child had a fever or something, they really can't...They really shouldn't be refusing, and we shouldn't really allow them to. RN_06

> The nurses tell me all the time, "You're doing our job for us," because I change his diapers, I weigh the diapers, I get him dressed, I change his clothes, I wash him up. I basically do everything that I do at home. Sometimes it's hard for them because I just do it all...There are times that I let them change his diaper. I don't completely like, "You can't touch him." It's just you know, they're busy too. I'm here 24/7, so I'm constantly checking his diaper or when he's hungry, I feed him. They do come in and do his feeds. He's on the pump for an hour at a time for his feeds and then overnight, he gets it over eight hours. So they do all of that because I'm sleeping at night, but I feel comfortable to sleep and let them do whatever they need to do with him at night. Family_16

Conditions that Block, Facilitate, or Shape Role Integration in Surveillance Activities: Parent Stress, Trusting Relationships, Nurse and Parent Availability, and Prolonged Hospitalization

Integrating roles in surveillance was influenced by parents' stress and coping, the level of trust between parents and nurses, and the availability of the parent or nurse to identify and respond to changes in patient condition. Prolonged hospitalizations and chronic illness redefined protocols for responding to surveillance triggers and how condition changes were managed.

Parent stress and coping.

Both nurses and parents acknowledged that parental fear, stress, lack of sleep and nutrition, as well as and lack of knowledge and uncertainty about disease, treatments, and hospital workflows created parent stressors that influenced collaboration between parents and nurses. These stressors sometimes manifested in frequent calls for reassessment and often strained collaborative efforts at decision making and maintaining adherence with treatment schedules.

> They're [parent] helpful to a certain extent. But when the questions and concerns start to distract from the patient care itself, I think that's when it kind of crosses the border from being helpful to more of a juggle of trying to balance patient care and family reassurance. That's where bringing in the extra team members help, because someone can really focus and talk to the parents while the nurses and staff seeing the patient and seeing any changes and then the balance kind of evens out. RN_12

> There again, I mean it's a combination of what the parent's feeling, mentally and emotionally, what they're going through, you know, but I can see where that would hinder the nurses' jobs, because the parents are scared, confused, worried. And develop anxiety from those things. And a lot of parents, even I've developed it a little bit. But there are people that just can't manage that very well in a cool fashion, and communicate in a healthy way, to where it doesn't hinder the situation any, whether it's the nurse doing her job or the child being in the middle of it. So I could see that, I could definitely see that. Family_13

Nurses had different perspectives on the impact of repeated family requests on efforts to collaborate in surveillance activities. For some, frequent calls were viewed as repeated opportunities for re-evaluation of the patient and checking in with parents. Others felt they were distractions which down-regulated the nurses' sense of urgency to respond to possible concerning events. Still others interpreted the calls as an indicator of a patient to watch more carefully because of displaced family attention on other issues.

> We were just in a whirl wind of, everything happening, and we're, you know, it was hard for us to get our bearings. But she [the nurse] was really clear, and concise about what was going on, and what we could expect, and what was there to help us. She was like a good bridge between us and the doctors. I really felt like she was on our side. Family_06

> If the family's calling a lot because they're concerned, I would like to provide objective facts that they can see and understand . . . If they're concerned about, for example, a heart rate, I can explain what the heart rate looks like. If I do vitals, what that means, and if there's any changes, I would explain it to them. But typically, I will just make sure that the family understands what I'm looking for and reassure them that what I see in my assessments are reassuring. If that's not enough, I would get the medical team involved to also have that conversation with the family. RN_05

Common sources of stress for parents were delays in care, errors in medications or treatments, miscommunication or discontinuity of care between clinicians, and differences in nursing practices. To cope, parents resorted to chronicling dates, times, and conversations in an effort to keep track of interactions and assist in care coordination, and questioned practitioners about what they were doing and why before allowing care delivery. In response to practice

variations, parents questioned nurses about their rationale for the differences in technique, often expressing a preferred method. In some cases parents made technical changes (e.g. re-configuring tubing) after the nurse left the room if an error was suspected. These surveillance activities were sometimes interpreted by nurses as misaligned with the clinical priorities they were monitoring or concerned about, and required adaptive strategies to alleviate parent stress, increase trust, or re-negotiate expectations.

> The feeding bag was attached to their own port. It does attach to the medicine port, instead of the main port because it's supposed to be two…Yeah, so they attached to the one that was attached to the meds. I just waited until the nurse left and then, switched them myself…Yeah. I switched them myself because some of them are very particular about that and then, he's [the patient]very picky. Family_12

> Sometimes it's because they're frightened, for a number of reasons, they're frightened. Parents, they don't let them sleep. We don't let them eat. You know, they're frightened. They can perseverate on something that, for multiple reasons, aren't helpful in the big picture, or even the little picture, but that's sometimes...you know, we all deal with stress in a different way, so sometimes we have to sort that through. RN_03

Trusting relationships.

Parents developed trust in their nurse and the nursing unit to watch over their child when certain criteria were met: the nurse took time to get to know the patient, the parents perceived that the nurse 'really knew what she was doing' (i.e., was efficient and knowledgeable), the nurse collaborated with parents, the nurse advocated for the needs of the child; and there was good teamwork among the nursing staff. Nurses who were friendly, related with patients and parents on a personal level, individualized care, and demonstrated caring behaviors were considered a 'good' and trustworthy nurse. When these criteria were met, parents felt more comfortable stepping away from the bedside and relying on nursing to monitor their child.

> Yeah, I think a nurse ... my favorite nurses are the ones that come in and communicate and play with him and try to build that relationship and that trust level with him. Um, when you take the extra time to talk and interact with him, it makes him more comfortable. And, when he's more comfortable, I'm more comfortable. Family_04

> I wanted to run downstairs and buy him a balloon, so instead of you know, him screaming, they came in, and they were playing with him, and it really helped. It gave me a few minutes to go and catch my breath, and have some, you know, a little bit of time alone where I'm not, you know, stuck in here. I'm somewhere with him constantly. Family_01

Because much of daily patient care was provided by the parents, nurses were dependent on either overt physical signs or parents' signaling as indicators of when condition changes occurred. Nurses had to develop ways of ascertaining whether parents could be trusted to alert the nurse when changes occurred and for verifying the status of assessment data.

Nurses identified inconsistent or delayed communication of information among the care team and with parents as a deterrent to developing trust with parents. Parents often looked to nurses for information about changes in treatment decisions, scheduling of procedures, or timing of discharge. In some cases parents received updates prior to nurses. The nurses feared this inconsistent communication flow eroded parents' confidence and trust in the nurses' and the medical system resulting in parents stepping in to coordinate care.

> I would say that a lot of what we do as nurses is built on trust development and relationships with our families, when the nurse isn't looped in to the plan consistently, then the family's trust in us gets kind of skewed. Because that nurse doesn't know what's going on . . . they [physicians] sometimes will give a plan, but then they won't cue up the sole person who's going to be in this room every hour. So not only does that mess up the trust between the nurse-doctor . . . but it also messes with the family and the nurse relationship around trust as well. And so then once we've lost ground with them, it's really hard to get back . . . The next nurse, maybe it's a night shift nurse, doesn't have as much interfacing with the team, so they don't look like they know what's going on, and so it's just, I think there's a lot to be said for that as well, in terms of these parents feeling like we're not all on the same page. RN_09

Nurse and parent availability.

An aspect of parents developing trust was the availability of the nurse. For the most part parents were satisfied with how often their nurse checked in with them, however this was not the case in other hospital settings the parents had been to. Parents were aware of how busy nurses were, and often commented that one impetus for providing care was to relieve the burden of their nurse. Families valued the comradery and teamwork they witnessed among the nursing staff

which was demonstrated by other nurses readily responding to call lights, stopping in to visit with the parents and their child, and being available without hesitation to help other nurses when needed. This level of teamwork helped establish trust that their child was looked after not only by their nurse but also the rest of the nursing unit.

> I love how they work here. They are very, hmm, how do I want to say this. They are very, they communicate a lot and they are very helpful. Like one of the nurses they're walking by and they see that another one needs help then they ask her Oh do you need me to bring you something or I love how they are so close like help out they help each other a lot. And they communicate what they need and stuff. I love how they are here. Family_03

Nurses perceived patients who were left alone without parents at the bedside as a condition that posed increased risk for delays in recognizing changes in patient condition. This was especially true for very young, developmentally or cognitively impaired children who were nonverbal or unable to signal for help. Without parents to assist in on-going monitoring, nurses employed strategies to either increase patient visibility or put in place surrogate monitoring processes.

> I guess it would depend on their age...If they're under 18 and they don't have a parent we have sitters...If they're a kid who's unable to speak or because of their age, or unable to call us, or has been so sedated or something like that where they're not so alert and they're by themselves, yes. That would probably change my monitoring..."as far as the frequency of me in that room. I would definitely have them on pulse oxes and maybe CR [cardiac rate] monitors, things like that. RN_12

Prolonged hospitalization.

Long hospital stays and chronic illness habituated parents to the routines and accommodations of a clinical environment and skills of a nursing staff, such that when presented with changes in condition, some parents would negotiate longer periods of watchful waiting and interventional trials before agreeing with a transfer to a higher level of care. Likewise, nurses caring for long term patients became adept at identifying subtle changes and initiating mitigating actions quickly. They too preferred to manage the patient as long as they could on the acute care

floor, in part to appease the parents' appeals to remain on the floor, but also because the nurses felt they knew their patient's well and had specialized skills to anticipate potential changes and implement needed interventions. They were quick to add that if conditions warranted a higher level of care (e.g., 1 to 1 nursing, drugs or treatments that couldn't be provided on the floor) they would not hesitate to escalate their concerns or expedite transfer to the pediatric intensive care unit (PICU). In some cases, however; delaying the transfer of care to an environment better equipped for managing critically ill patients may have postponed the patient's receipt of critical treatment.

> We delayed the decision a little bit to stay on the unit and not go to the PICU, because she [the mother] knows how the nurses on our unit just knew him, she felt like we knew him a lot better, and we always managed him no matter how sick he got on our unit, and she didn't feel like there was any change at that moment, that would have triggered him to go to PICU . . . he probably should have gone sooner, but Mom was so adamant . . . RN_02

Actions/Interactions Associated with Integrating Roles in Patient Surveillance: Negotiating, Collaborating, Adapting

In order to integrate role priorities parents and nurses had to reach consensus on rules of engagement. This was done through negotiation and collaboration about role responsibilities and expectations, and adapting to individual actions and preferences of the other.

Negotiating.

During admission to the hospital, parents and nurses established the parents' wishes with regard to visitation and level of participation in their child's care. These preferences, in general terms, were documented for subsequent nurses to review, but required frequent revisiting with each new nurse, and modification depending on nurse comfort, availability of the parent, and the condition of the child. Most nurses were adept at integrating roles and sharing responsibilities with parents for nursing procedures and assisting the patient with activities of daily living;

abilities which nurses attributed to communication skills, and experience with evaluating parent capacity, establishing role boundaries, and setting limits.

> ...it's important that they, um, let me be involved, and they'll ask me if they'll come and ask me, "Mom, is that okay? Mom, how do you feel about this?" To me, that's really, really important because even though she's 20, she still...you know, I'm her advocate, I'm her caregiver. So I love how they include me with all of the treatments. Family_02

> In general, we usually have a discussion with the family to just call for any help. Nothing anticipatory. Or if they feel like the patient's getting sick, do this. But we always, at the beginning of your shift…what I would try to do is make a plan with the family. If there were anything specific that I'm worried about, we would talk about that and to call me immediately if that happens, a symptom or respiratory rate goes up or O2 saturation...typically just reminding the family to call me if they have any concern. RN_05

Nurses negotiated times with parents to evaluate the patient such as during diaper changes, feeding administrations, or bathing. Nurses clarified information they wanted to know in order to monitor patient progress, and highlighted condition changes that warranted notification.

> Families that are helpful on my floor, a big part of our day is monitoring input and output. So especially with babies or young patients, but families who write down on a board, we have white boards in the room, so if they would write down what their kid had eaten and had to drink, that would be really helpful. Families who remember to keep diapers in a bin we put out for them instead of throwing them away. Families who are good about remembering if their child's going to go down for a nap. Maybe if they call us and say, "They're about to go to sleep, do you want to do vitals before they go to sleep?" Parents who notice changes themselves and call and say, "What do you think about this? Do you think this is different? RN_12

Patients with chronic conditions tended to have repeated periods of instability with successful recovery. This capacity for resilience recalibrated how recurring and new condition changes were interpreted and treated. Trials of rescue treatments (e.g. antiepileptic medications, blood transfusions) and temporizing measures such as position changes, suctioning, or increasing oxygenation often bought time for the patient to recover, thus adverting transfer to a higher level of care. Consequently parents and nurses became confident in the patient's fortitude and nurses skill at handling periods of instability. This, coupled with the parents' and patients' comfort in their residence on the acute care floor, and nurses' and physicians' resolve to manage their 'own'

patients, resulted in trials of watchful waiting and successive interventions. The decision to transfer was therefore made with a great deal of discussion and collaboration between parents, nurses, and physicians.

> I think that, my personal view, the parents that don't have chronic kids are very good at picking up when their child changes. Not that the chronic kids don't, but I think that they . . . for the parents that don't have chronic kids, their kids are healthy most of the time, so they know when their kid's baseline is. But I feel like they pick up a lot, like even the subtle things. Chronic parents also pick up those things, I feel like they also manage a lot of those things as well so their level of alarm is not, wouldn't be as high as a parent who has never experienced that. RN_02

> I know some families . . . are on the unit for a very long time, they don't particularly want to go to the ICU, even though their kid might be decompensating rapidly. So I have heard and seen families say that don't want to go to the ICU . . . I know sometimes the physicians might want to hold onto the patients . . . Which ends up being a little bit of a problem because the kid just gets sicker on the floor and we can't intervene as quickly as appropriately. RN_01

Once nurses felt resources to safely care for the patient on the acute care unit were nearly exceeded however, they began to negotiate with parents and physicians to define mutually agreeable indicators of improvement or deterioration and targets, both outcomes and extent of intervention.

Collaborating.

Perhaps the most effective process in patient surveillance was the collaboration between parents and nurses on recognizing and managing condition changes.

Establishing a baseline, recognizing and evaluating condition changes.

During admissions to the hospital parents provided background information about the past trajectory of their child's illness and medical history. This provided baseline information for the nurse to normalize assessment findings, anticipate expected patterns, and evaluate future changes in patient condition.

> I think the most helpful component for the family members is providing the baseline and seeing what's different. RN_12

> I'm the key piece of this puzzle. I'm, like, the key member of this team. And it took me a long time to realize that, and it's the one thing I tell, like, parents that are just starting a journey that

> might take a long time is that, like, they're the team captain. They're the ones that make the calls, they're the ones that keep all the pieces together...Family_04

Nurses employed strategies to achieve consensus with parents on surveillance objectives. Nurses described the patient data they were intersted in and why, provided objective indicators of patient progress, stability, or concern, and established frequency of parent check-ins. Because of their continual presence at the bedside, parents were often the first to see and call out nuanced and overt changes in their child's demeanor, cognitive or functional ability, or physical signs and symptoms. By noticing and speaking up about these changes it focused the nurse's attention on potentially harmful situations.

> It's also a part of my job to help the parents feel comfortable. And so whether that means checking on them more frequently for a short period of time and telling them I'll be back at this time and actually coming back at the time I say I'm going to come back so the parents see that I am taking them seriously and see their child. That I am assessing them, and increasing my care a little bit, get the doctors in there to help back me up if I think that the patient's fine... RN_04

> I said, "[nurse], he just does not look good." She was like, "He really doesn't."...Then all of a sudden, he just kind of went blank. I said, "I think he's starting to have a seizure." As soon as I said that...he started to fall over so I grabbed him and laid him back... Family_16

Parents helped nurses collect patient data through recounting observations, measuring patient indices or interpreting patient representations of their symptoms. One patient was describing his pain to his nurse which had to be translated by his parent.

> He said I feel like there is a fish swimming in my body...so the nurse says, okay, so he's seeing a fish. So I go no, you asked him about his pain level or what he's feeling, he's not seeing a fish,… He's always given similar descriptions like this even as a child. He'll use an animal, some animal that swims, use that as a description of, an analogy of what he's feeling in his body. Family_06

Often parents would undertake collecting their own assessment data in situations where they were concerned. When condition changes were observed by either parents or nurses, in most cases they alerted the other, and together evaluated the patient, and decided whether to wait and watch, escalate or intervene. Both parents and nurses acknowledged that each has independent

knowledge about the patient's condition and that working together was in the best interest of the child.

> ...the doctors wanted to jump in and stop using his line and start an IV. And the nurse and I were able to kind of come up with a plan to really see if it was a line issue or a medication issue. And so, we were able to think outside of the box and kind of recreate steps to, to see if we could find out what was causing the issue. And we were able to do it without starting an IV...without causing him extra trauma. Family_04

> I feel like when nurses and parents work together, the parents knows more about the child personally and what their triggers are, how they are at home with their condition and all that stuff. But the nurse obviously has the medical insight. I think listening and having that open communication is helpful. Family_15

> I remember them [physicians] feeling all very similar to me. I remember them being like, if Mom feels like he can be cared for there, and she knows him best, I think he is okay, until we have some sort of real tangible reason to transfer him. RN_02

Managing condition changes.

Parents and nurses described their activities working together in situations in which a condition change was evolving or a dilemma in care arose. In these circumstances parents and nurses acted by calling attention to changes, talking with each other to determine the significance of the changes, and jointly devising a plan to address the issue at hand. Parents applied knowledge from previous experiences to direct problem solving and determining a course of treatment.

> Mom noted he was having more coughing episodes...We noticed throughout the night that he was coughing more...The coughs turned into multiple cough attacks...You could see that his belly started to kind of, he was just kind of having difficult respirations and retractions...It turned out he had pneumothorax that was caught super super early. So he was moved to the PICU. RN_11

> Most of the time it could be she is running a high fever or just so many things at the same time, and sometimes I really have to tell doctors, "No, no, no, it's not that. It's got to be this. Family_02

Parents often acted as the buffer for the nurse, cajoling or convincing their child into accepting treatments. In some cases, parents even initiated or instructed nurses on the appropriate course of action.

> I was in BMT and I just stepped out of the room of the baby and all of a sudden, I hear a code. My phone's going off and I look up and it's my kid's room. The dad had called the code because

> after I stepped out of the room, the kid stopped breathing...So yes, in that situation, the dad was very much on it. RN_06

> I won't stop them from taking out a line that's bad and inserting a new one, and poking him because if they see it's bad...But it has to be done. The thing is also you have to communicate with your child and explain to them because for me, hopefully they'll listen to you first...When he was really feeling bad, he'd say, "Whose side are you on anyway, mom?" I said, "I'm on the side of those who want you to get better. Family_12

When a child's condition worsened acutely parents typically remained in the room and answered questions about recent events that occurred prior to deterioration. In some emergent situations parents initiated comfort measures, called for help, or if accustomed to sudden changes initiated position changes. Nurses conveyed that parents were generally escorted to a corner of the room where a social worker or chaplain would provide support. Parents who maintained a position over their child's bed would be assisted to step aside to allow the on-coming team of clinicians access to the patient.

Adapting.

Nurses relayed ways in which they adjusted their surveillance routines to accommodate the needs of the patients and parents. Patients who were often alone and nonverbal were moved to rooms closer to nursing work areas so they were visible or easily heard. For closer watching, patients were assigned a sitter or attached to physiologic monitoring.

Nurses also adapted their surveillance routines to mesh with those of the parents. As much as possible nurses varied the timing of patient assessments to coincide with other tests or nursing activities. If parents or patients preferred the parent providing care, nurses found ways to oversee care delivery so they could be present for assessments and complete documentation. Nurses stressed the importance of listening carefully to parents' concerns and adjusting priorities to address them. If parent concerns about their child's condition could not be assuaged, the nurse verified her assessments and plans for monitoring with senior nurses and/or medical staff.

To adapt to parent stress, nurses attempted to establish rapport, create consistency and clarify treatment and monitoring goals. Table 4.5 lists actions nurses implemented, or families suggested, as ways to work with families to reduce stress and maintain adherence to surveillance protocols.

> In general, we usually have a discussion with the family to just call for any help. Nothing anticipatory, or if they feel like the patient's getting sick, do this, but we always, at the beginning of your shift, what we try to do, or what I would try to do, is make a plan with the family. If there were anything specific that I'm worried about or the patient's family is worried about, we would talk about that and to call me immediately if that happens, a symptom or respiratory rate goes up or O2 saturation. It's only if they can see that, if the patient's on a monitor, but if they're not, typically just reminding the family to call me if they have any concern. RN_05

Typically parents made adjustments within their family so that one parent was available to stay with their hospitalized child. However, if parents suspected that clinicians were not attentive, made mistakes, missed changes in their child's condition, or there was a lack in continuity or communication among the care team, parents took additional actions to assure the welfare of their child. These activities include organizing themselves to ensure constant presence at the bedside and cross-checking nursing actions. Parents monitored adherence to medication regimens, questioned appropriateness of treatment, escalated concerns about signs of decline, and interceded when they thought the actions of nurses might cause patient harm or in situations where errors occurred. Parents expressed having to assert their opinions or concerns, or in some cases take action, when clinicians either dismissed or minimized the parent's assessment, or failed to initiate treatment. In some situations parents adjudicated whether treatment was done or not.

> They gave it [dilaudid] too. I felt like some of the nurses weren't reading the prior notes. Because had that nurse read the notes from before that person would have seen that he hadn't been on narcotics, and the reasons why. So then, we started like, every time they came in with some kind of injection we would always have to ask what are [you]giving him, what is that for, when was his last dose...nurses were probably pissed off or irritated, but we would always question it... Family_06

Consequences of integrating roles: working together, conflicts

In situations where parents and nurses integrated their roles in surveillance, nurses and parents worked together to identify patient condition changes and initiate corrective measures early. For parents, this meant that nurses listened to them when condition changes were pointed out, took action to investigate or mitigate symptoms, included the parents in evaluation and decision making, and consulted with other clinicians when condition changes persisted. Similarly for nurses, optimal surveillance meant early identification of physiologic changes with the assistance of parents watching the patient, ability to assess the patient independent of parent input, ability to adjust monitoring based assessment findings, and make decisions with parents about treatments based on objective criteria. Consequences of working together effectively were opportunities for enhanced learning and improved recognition and management of condition changes. Nurses and parents described experiences that suggested this occurred most of the time which was reflected in one parent's account of a time when her son experienced changes in his cardiac rhythm:

> He was hooked up to a heart monitor and the alarm kept going off. He was having a prolonged QT in between beats. So he kept setting his monitor off. And he just was more sleepy that usual and trying to figure out why that was happening. I saw it first. I called the nurse and said that his numbers were off and she came in and sat with us. And we watched his numbers, and we watched the monitor. We just sat there and we did a lot of watching before we started reaching out to teams. So the doctors and everybody were in and out of our room for a few hours, trying to figure out what was happening. Family_04

Conflicts arose when these ideals were not realized. This occurred in cases where parents controlled the environment or access to the patient, or interfered with completion of tests or treatments. In these situations nurses attempted to work with the parents to align priorities and establish agreements to follow the plan of care. There was recognition among the nurses that some were better at establishing rules and clarifying boundaries than others.

> Nurses get nervous about boundary-setting where I need to go in and get these assessments done on this patient that is potentially going to decompensate because they're getting sicker, but mom is resistant . . . Certain nurses who have experience or maybe who are a little more assertive have the ability to get in there and advocate, and there are other nurses who don't have that ability, whether it's their personality or their skill level, I would like to think that they would then have the strength to go to someone who does have the ability to say, "We're concerned. We need to help your child. RN_09

During this process of negotiation sometimes treatments were delayed or care was missed. If talking with parents was unsuccessful, nurses asked for assistance from administrative leaders or the physician team to clarifying roles, responsibilities, and expectations.

Likewise, if parents felt they weren't being heard they repeated their concerns to others clinicians until a satisfactory response was provided. If they experienced discord with a nurse over negotiating role responsibilities, or perceived a lack in nurse professionalism, accountability, or caring behaviors, parents requested a different nurse or escalated their concerns to administrative or clinical leaders.

> I've had a ... I don't even remember what the specific, but I've had a couple of instances, like, where nurses haven't jumped on things and gotten things done the way that they should have done. I don't remember what led up to that. I just remember specifically asking to not have that nurse after that day. Family_04

Discussion

We set out to ascertain the factors that influence nurse and parent role integration in surveillance of hospitalized pediatric patients. Parent descriptions of surveillance experiences coalesced around accounts of monitoring their child's condition as well watching for and arbitrating differences in clinical practice, preventing errors, and coordinating efforts and communication between practitioners. This represents a sophisticated comprehension of safety surveillance as has been reported previously (Cox et al., 2013; Khan et al, 2016; O'Hara et al., 2017).

We found that role integration was shaped by stressors imposed by the hospital environment, availability of the nurse and parent, and the socialization that occurs with

prolonged hospitalization. In response to these conditions, integrating surveillance activities between parents and nurses required negotiating and collaborating on role expectations and scheduling of care delivery, and adaptations to how nurses interacted with parents and patients and/or parent vigilance in surveillance. Effective integration resulted in coordination of efforts between parents and nurses and a perception that patients were being adequately monitored and treated for condition changes. Unmet expectations led to role conflicts, perceived barriers to surveillance, and concerns for potential missed or delays in care. This explanation of role integration is a new contribution to our understanding of the factors that influence surveillance efficacy.

Previous studies looking at interaction of parents and nurses during hospitalization of pediatric patients found there were differences in expectations for care delivery between the two groups (Power & Franck, 2008; Coyne, 2015). Unlike previous reports, nurses in this study did not expect parents to provide care or remain in attendance. This may reflect better nurse to patient ratios in the study facility because of regional staffing requirements or acuity of a quaternary referral center, or that the study population was cared for in hospital specializing in pediatric care. Similar to these previous studies, we found most parents wanted to provide the majority of daily care, including technical aspects of care if it was part of the routine already established at home. Nurses apprehension about accountability for assessments, appropriate action for abnormal surveillance findings, completion of technical tasks, and documentation of care were similarly found in earlier studies (Power & Franck, 2008); however, in our study nurses identified strategies to overcome nurses' apprehension and meet their needs for accountability, such as overseeing parent activities, limit setting, frequent check-ins with parents,

consensus building on signs of improvement, deterioration, or when to call the nurse, which had not been previously described.

In general, parents wanted to remain at the bedside to comfort their child, advocate for their child's needs, and participate in decision making. Nurses extolled the benefits of having parents readily accessible to provide baseline information, assist with validation of assessment findings, and corroborate on initial management of condition changes. Indeed alternative arrangements were made for high risk patients when parents were not available.

In some cases parents maintained constant vigil to protect the safety of their child. Similar to prior reports, this vigilance occurred when errors were witnessed or if parents perceived discontinuity of care or communication between providers (Dudley & Carr, 2004; Hurst, 2001, Rosenberg et al, 2016). We found, in general, parents were vocal about their concerns for safety. They described instances in which they challenged differences in practice, pointed out or circumvented errors, and questioned the rational for tests, treatments, or procedures. In some cases however, parents opted to remain silent assuming nurses and doctors knew what they were doing. These findings are similar to speaking up behaviors described of parents in other pediatric and neonatal ICU settings (Hurst, 2001; Lyndon et al., 2017; Rosenberg et al., 2016).

Clinical and Research Implications

When a child is hospitalized nurses must be prepared to partner with parents in activities of patient surveillance. Parent engagement in these activities can be a facilitator or barrier to nurses' accountability for patient surveillance. An understanding of the situations and interactions that impact how parents facilitate or hinder surveillance provides clinicians' insights into how to integrate role expectations and responsibilities.

Knowing that parents view their primary roles as advocate and decision maker should provide a basis for conversations about indicators for condition changes, how these will be monitored, and potential actions to take if the patient's condition worsens. Soliciting (a) baseline information, (b) observations on patient condition, (c) interpretations of patient assessments, (c) suggestions for causes of changes, and (d) agreements on treatment options are ways to promote parent advocacy and decision making in surveillance. Negotiating times for patient evaluation within established family routines accommodates the nurse's need for accountability for surveillance data and the parent's needs for involvement, control, and predictability.

Parents delineated concerns for safety (e.g. medical errors), variation in clinical practices, and discontinuity in communication and care planning as reasons for their increased surveillance behaviors which sometimes interfered with the nurse's ability to monitor the patient and execute treatment. Developing mechanisms for parents to voice concerns, discuss distressing observations and experiences, and participate in care planning with nurses and physicians would facilitate shared treatment planning and problem solving.

Parents described nurses who took time to get to know the patient and family personally, and listened to and advocated for their special needs as demonstrating behaviors that garnered parent confidence in lessening their guard on constant surveillance. Some nurses articulated successful strategies they used with families who were controlling or frequently called for assistance. Providing opportunities for nurses to share how they develop rapport with families and alleviate family stressors associated with hospitalization might help reduce distractions, and align surveillance activities.

Limitations

Limitations of this study include sample and setting. A limited number of study participants were recruited from a single institution. Parents were English speaking, mostly female (68%), had at least a high school education, and able to spend most of their time at the bedside. Access to parent participants was controlled by nurses in charge or caring for the patient. Nurses were almost exclusively female (92%), identified as White or Asian, and had a BSN (54%) or MSN (46%). Parents or nurses with different characteristics and circumstances may have very different experiences with role integration in surveillance. The institution was a single site quaternary referral children's hospital, with staffing ratios and support personnel that may be different from other hospital settings. The specialized care provided at this institution created circumstances resulting in recurrent patient visits and prolonged hospital stays. These sampling and setting variables may limit the transferability of the findings, however; most findings were consistent with outcomes previously reported.

Conclusions

Little attention has been paid to optimizing role integration of parents and nurses in surveillance as a means of improving early recognition and management of condition changes. This study suggests that role integration is influenced by processes and norms of the hospital, parent perspectives on caring for their child while in the hospital, and nurse duty to be accountable for patient assessment and management of condition changes. Nurse and parent availability and trust in one another, parent stress and coping, and prolonged hospitalizations were lever conditions that altered surveillance intensity and patient management. To achieve perceptions of optimal surveillance nurses and parents toggled between collaborating; negotiating; and adapting to what was monitored, by whom, when, and how. These processes at

times achieved the goal of optimal surveillance and at other times resulted in conflicts. Parents felt the need to increase surveillance if they felt their child's safety was at risk or if they perceived a lack of care continuity. More work is needed to understand how to increase parent confidence and better align surveillance activities when there are conflicts.

Table 4.1
Parent Interview Guide

	Questions
1.	How long has your child been in the hospital?
2.	Is this the first time?
3.	I imagine you have come in contact with a number of nurses since you have been here. What differences have you noticed in how they provide care to your child and interact with you and your family?
4.	What worries you about your child's condition? What are your thoughts about whether people are watching for these things?
5.	Have you ever been in a situation where you thought something was not going well for your child and you felt like was it handled well? Tell me about how that went.
6.	Have you had a situation where something was not going well and you had difficulty Getting a response. How did that go?
7.	Were you aware that something was wrong? How did you know?
8.	Tell me about how the nurse or nurses responded to the situation?
9.	Do you have any thoughts about how culture might influence safety in these situations?
10.	Is there anything more you feel I should know about what we have been talking about? Is there anything I haven't asked that you want to say?

Table 4.2
Nurse Interview Guide

	Questions
1.	Tell me about your experience with pediatrics patients?
2.	What kinds of patients do you work with?
3.	I imagine during your time caring for patients there have been occasions when you helped prevent them from becoming unstable. Tell me about a time in which your patient experienced a change in condition and you remember it as a good save; a time you felt you influenced the outcome of your patient.
4.	I am interested in knowing about a time when you were really worried about your patient's condition because it looked like it was going to get much worse; someone you felt you had to watch very carefully. Tell me about that experience.
5.	Tell me about a time when a patient deteriorated who did not recover or who was transferred. Can you walk me through that?
6.	What worked well in that situation? What was difficult? Can you tell me how you recognized any changes in the patient's condition?
7.	Where was the family when this was happening? What was their role in the situation?
8.	Do you have any thoughts about how culture such as work environment and relationships might influence the safety of patients in these situations?
9.	Is there anything else you would like to tell me about? What haven't I asked you about that I should have?

Table 4.3
Characteristics of Parent and Nurse Participants

Parent Characteristics (n = 16)	
Gender	11 (68%) female
Age years; median (range)	37 (26-57)
Race number (percent of sample)	
White	5 (31%)
Asian	4 (25%)
Black	1 (6%)
Hispanic	6 (37%)
Education	
High School	6 (38%)
Undergraduate studies	8 (50%)
Graduate studies	2 (12%)
Occupation	
Service/technical	5 (31%)
Professional/manager	3 (19%)
Homemaker	8 (50%)
Marital Status	
Single	6 (38%)
Partnered/Married	10 (62%)
Child age years; median (range)	9 (1.3-20 yrs)
Child Condition	
Cancer	4 (29%)
Intestinal disease	4 (29%)
Neuro impairment	3 (21%)
Bronchiectasis	1 (7%)
Autoimmune	2 (14%)

(continued)

Nurse Characteristics (n = 13)	
Gender	12 (92%) female
Age years; median (range)	34 (25-58)
Race	
White	7 (54%)
Asian	6 (46%)
Education	
Undergraduate studies (BSN)	7 (54%)
Graduate studies (MSN)	6 (46%)
Years in Pediatrics years; median (range)	10 (2-18)

Table 4.4
Explanatory Matrix

Perspective: Integrating the roles of nurses and parents in patient surveillance

Context	Conditions	Processes	Consequences
Hospital and unit social norms • Standards/policies /procedures • Hierarchy Differences in perceived roles, responsibilities and accountabilities • Nurse accountability for assessment, caring out orders, complying with the hospital/unit standards • Parents role, something that nurses have to learn Parent and patient social norms and routines at home • Parents provide care • Established routines • Perceptions of care providers as all knowing	Parent stress and coping with the hospital environment. Nurse and Parent Availability Trust Prolonged Hospitalization	Negotiating • Deciding who will do what with respect to patient care • Deciding how the nurse will get access to the patient for assessments • What to do with condition changes in chronic patients Collaborating • Exchanging data at baseline and ongoing assessments • Managing changes in condition Adapting • Parents maintain presence • Accommodating parent's routines, adjusting schedules • Patient's without parents • Nurses adapting to parent stress	Conflicts • Parents interfering with nurses ability to evaluate the patient or comply with hospital routines • Nurses not doing things according to parent routines, desires • Errors made by nurses Delays in acting on changes in the patient Missed care Early recognition and management of condition changes A positive sense of teamwork

Table 4.5

Recommendations for Reducing Stress and Increasing Collaboration for Surveillance

Strategies for Establishing Rapport
• Take time to actively listen to parents concerns • Take concerns seriously • Encourage families to write their concerns and questions down • Assist parents in obtaining resolution of their concerns   – Enlist medical team to evaluate and provide their opinion • Align concerns of family with concerns of nurse • Negotiate times when the RN can be present for care delivery by parents • Explain procedures, what will be done, what to expect • Arrange consistent nurse assignments with the same patient over time • Anticipate future needs
Strategies for Communicating Surveillance Routines

• Explain the rationale for surveillance
  – course of treatment and assessment routines
  – expected findings/changes and their significance
  – implications for surveillance frequency
• Set expectations for surveillance routines and their rationale
• Explain information often using multiple formats

Align concerns of family with concerns of nurse
• Enlist the parents help with watching for changes in condition • Tell parents what patient data, signs, and symptoms are of interest and why • Provide objective facts about the patient's condition that parents can see and understand • Increase frequency of monitoring when families express concerns • Establish frequency of check-ins with family • Point out signs/symptoms that indicate condition progress or stability

References

Agency for Healthcare Research and Quality. (2011). Twenty tips to help prevent medical errors: patient fact sheet. AHRQ Publication No. 11-0089. Rockville, MD: Agency for Healthcare Research and Quality. Retrived from https://www.ahrq.gov/patients-consumers/care-planning/errors/20tips/index.html

Bavare, A. C., Thomas, J. K., Elliott, E. P., Morgan, A. C., & Graf, J. M. (2017). Family-initiated pediatric rapid response: characteristics, impetus, and outcomes. *Journal for Healthcare Quality, 40*(2), 103-109. https://doi.org/10.1097/JHQ.0000000000000096

Blower, K. & Morgan, E. (2000). Great expectations? Parental participation in care. *Journal of Child Health Care, 4*(2), 60-65. https://doi.org/ 10.1177/136749350000400203

Bonafide, C. P., Holmes, J. H., Nadkarmi, V. M., Lin, R., Landis, R., & Keren, R. (2012). Development of a score to predict clinical deterioration in hospitalized children. *Journal of Hospital Medicine, 7*(4), 345-349. https://doi.org/10.1002/jhm.971

Brady, P. W., & Goldenhar, L. M. (2014). A qualitative study examining the influences on situation awareness and the identification, mitigation and escalation of recognised patient risk. *BMJ Quality & Safety, 23*(2), 153-161. https://doi.org/10.1136/bmjqs-2012-001747

Brady, P. W., Zix, J., Brilli, R., Wheeler, D. S., Griffith, K., Giaccone, M. J.,…Tegtmeyer, K. (2015). Developing and evaluating the success of a family activated medical emergency team: A quality improvement report. *BMJ Quality & Safety, 24*(3), 203-211. https://doi.org/10.11336/bmjqs-2014-003001

Brilli, R. J., Gibson, R., Luria, J. W., Wheeler, T. A., Shaw, J., Linam, M.,…McBride, M. (2007). Implementation of a medical emergency team in a large pediatric teaching hospital prevents respiratory and cardiopulmonary arrests outside the intensive care unit. *Pediatric Critical Care Medicine, 8*(3), 236-246. https://doi.org/10.1097/01.PCC.0000262947.72442.EA

Bsharat, S., & Drach-Zahavy. (2017). Nurses' response to parents' 'speaking-up' efforts to ensure their hospitalized child's safety: an attribution theory perspective. *Journal of Advanced Nursing, 73*(9), 2118-2128. https://doi.org/10.1111/jan.13282

Bulechek, G. M., Butcher, H., Dochterman, J. M., & Wagner, C. M. (2013). *Nursing interventions classification (NIC;* 6th ed.). St. Louis, MO: Elsevier.

Charmaz, K. (2014). *Constructing grounded theory* (2nd ed). Los Angeles, CA: Sage.

Clarke, A. E. (2003). Situational analyses: Grounded theory mapping after the postmodern turn. *Symbolic Interaction, 26*(4), 553-576. https://doi.org/10.1525/si.2003.26.4.553

Cox, E. D., Carayon, P., Hansen, K. W., Rajamanickam, V. P., Brown, R. L., Rathouz, P. J., …Buel, L. A. (2013). Parent perceptions of children's hospital safety climate. *BMJ Quality & Safety*, *22*(8), 664-671. https://doi.org/10.1136/bmjqs-2012-001727

Coyne, I., & Cowley, S. (2007). Challenging the philosophy of partnership with parents: A grounded theory study. *International Journal of Nursing Studies, 44*(6), 893-904. https://doi.org/10.1016/j.ijnurstu.2006.03.002

Coyne, I. (2015). Families and health-care professionals perspectives and expectations of family-centred care: Hidden expectations and unclear roles. *Health Expectations, 18*(5), 796-808. https://doi.org/10.1111/hex.12104

Cox, E. D., Hansen, K., Rajamanickam, V. P., Brown, R. L., Rathouz, P. J., Carayon, P.,…Kelly, M. M. (2017). Are parents who feel the need to watch over their children's care better patient safety partners? *Hospital Pediatrics, 7*(12), 716-722. https://doi.org/ 10.1542/hpeds.2017-0036

Daniels, J. P., Hunc, K., Cochrane, D., Carr, R., Shaw, N. T., Taylor, A.,.…Ansermino, M. (2012). Identification by families of pediatric adverse events and near misses overlooked by health care providers. *Canadian Medical Association Journal, 184*(1), 29-34. https://doi.org/10.1503/cmaj.110393

Davis, R. E., Sevdalis, N., & Vincent, C. A. (2012). Patient involvement in patient safety: The healthcare professional's perspective. *Journal of Patient Safety, 8*(4), 182-188. https://doi.org/10.1097/PTS.0b013e318267c4aa

Doherty, C., & Stavropoulou, C. (2012). Patients' willingness and ability to participate actively in the reduction of clinical errors: A systematic literature review. *Social Science & Medicine, 75*(2), 257-263. https://doi.org/10.1016/j.socscimed.2012.02.056

Duncan, H., Hutchison, J., & Parshuram, C. S. (2006). The paediatric early warning system score: A severity of illness score to predict urgent medical need in hospitalized children. *Journal of Critical Care, 21*(3), 271-279. https://doi.org/10.1016/j.jcrc.2006.06.007

Dudley, S. K., & Carr, J. M. (2004). Vigilance: The experience of parents staying at the bedside of hospitalized children. *Journal of Pediatric Nursing, 19*(4), 267-275. https://doi.org/10.1016/j.pedn.2004.05.008

Espezel, H. J. E., & Canam, C. J. (2003). Parent-nurse interactions: Care of hospitalized children. *Journal of Advanced Nursing, 44*(1), 34-41. https://doi.org/10.1046/j.1365-2648.2003.02765.x

Frey, B., Ersch, J., Bernet, V., Baenziger, O., Enderli, L., & Doell, C. (2009). Involvement of parents in critical incidents in neonatal-paediatric intensive care unit. *Quality & Safety in Health Care, 18*(6), 446-449. https://doi.org/10.1136/qshc.2007.025023

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: strategies for qualitative research.* New York: Aldine De Gruyter.

Haines, C., Perrott, M., & Weir, P. (2006). Promoting care for acutely ill children – development and evaluation of a pediatric early warning tool. *Intensive & Critical Care Nursing, 22*(2), 73-81. https://doi.org/10.1016/j.iccn.2005.09.003

Hurst, I. (2001). Vigilant watching over: Mothers' actions to safeguard their premature babies in the newborn intensive care nursery. *Journal of Perinatal and Neonatal Nursing, 15*(3), 39-57.

Kelly, L., & Vincent, D. (2011). The dimensions of nursing surveillance: A conceptual analysis. *Journal of Advanced Nursing, 67*(3), 652-661. https://doi.org/10.1111/j.1365-2648.2010.05525.x

Khan, A., Furtak, S., Melvin, P., Rogers, J. E., Schuster, M. A., & Landigran, C. P. (2016). Parent-reported errors and adverse events in hospitalized children. *JAMA Pediatrics, 170,* 1-15, e154608. doi:10.1001/jamapediatrics.2015.4608.

Khan, A., Coffey, M., Litterer, K. P., Baird, J. D., Furtak, S. L., Barcia, B. M.,…Landrigan, C. P. (2017). Families as partners in hospital error and adverse event surveillance. *JAMA Pediatrics, 171*(4), 372-381. https://doi.org/10.1001/jamapediatrics.2016.4812

Kools, S., McCarthy, M., Durhan, R., & Robrecht, L. (1996). Dimensional analysis: Broadening the conception of grounded theory. *Qualitative Health Research, 6*(3), 312-330.

Kotsakis, A., Lobos, A. T., Parshuram, C., Gilleland, J., Gaiteiro, R., Mohseni-Bod, H.,…Bohn, D. (2011). Implementation of a multicenter rapid response system in pediatric academic hospitals is effective. *Pediatrics, 128*(1), 72-78. https://doi.org/10.1542/peds.2010-0756

Lyndon, A., Wisner, K., Holschuh, C., Fagan, K. M., & Franck, L. S. (2017). Parents' perspectives on navigating the work of speaking up in the NICU. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 46*(5), 716-726. https://doi.org/ 10.1016/j.jogn.2017.06.009

Martinez, P. A. & Totapally, B. R. (2016). The epidemiology and outcomes of pediatric in-hospital cardiopulmonary arrest in the United States during 1997-2012. *Resuscitation, 105*(2016), 177-181. https://doi.org/10.1016/j.resuscitation.2016.06.010

McCabe, A., Duncan, H., & Heward, Y. (2009). Paediatric early warning systems: where do we go from here? *Paediatric Nursing, 21*(1), 14-17. 10.7748/paed2009.02.21.1.14.c6907

Meyer, G. A., Lavin, M. A., & Perry, A. G. (2007). Is it time for a new category of nursing diagnosis? *International Journal of Nursing Terminologies and Classifications, 18*(2), 45-50. https://doi.org/10.1111/j.1744-618X.2007.00049.x

Miller, M. R., Elixhauser, A., & Zhan, C. (2003). Patient safety events during pediatric hospitalizations. *Pediatrics, 111,* 1358-1366. https://doi.org/10.1542/peds.111.6.1358

Mishra, S. R., Haldar, S., Khelifi, M., Pollack, A. H., & Pratt, W. (2018). Must we bust the trust? Understanding how the clinician-patient relationship influences patient engagement in safety. *AMIA…Annual Symposium proceedings, 2018,* 1425-1434.

O'Hara, J. K., Reynolds, C., Moore, S., Armitage, G., Sheard, L., Marsh, C.,…Lawton, R. (2018). What can patients tell us about the quality and safety of hospital care? Findings from a UK multicenter survey study. *BMJ Quality & Safety, 27*(9), 673-682. https://doi.org/10.1136/bmjqs-2017-006974.

Paciotti, B., Roberts, K. E., Tibbetts, K. M., Paine, C. W., Keren, R., Barg, F. K.,…Bonafide, C. P. (2014). Physician attitudes toward family-activated medical emergency teams for hospitalized children. *The Joint Commission Journal on Quality and Patient Safety, 40*(4), 187-192. https://doi.org/10.1016/S1553-7250(14)40024-2

Pearson, G. (Ed.). (2008). *Why Children Die: A Pilot Study 2006*; England (South West, North East and West Midlands), Wales and Northern Ireland. London: Confidential Enquiry into Maternal and Child Health (CEMACH).

Power, N., & Franck, L. (2008). Parent participation in the care of hospitalized children: A systematic review. *Journal of Advanced Nursing, 62*(6), 622-641. https://doi.org/10.1111/j.1365-2648.2008.04643.x

Roden, J. (2005). The involvement of parents and nurses in the care of acutely-ill children in a non-specialist paediatric setting. *Journal of Child Health Care, 9*(3), 222-256. https://doi.org/10.1177/1367493505054419

Rosenberg, R. E., Rosesnfeld, P., Silber, B., Deng, S., & Sullivan-Bolyai, S. (2016). Parents' perspective on "keeping their children safe" in the hospital. *Journal of Nursing Care Quality, 31*(4), 318-326. https://doi.org/10.1097/NCQ.0000000000000193

Sawhney, P. N., Davis, L. S., Daraiseh, N. M., Belle, L., & Walsh, K. E. (2017). Barriers and facilitators of adverse event reporting by adolescent patients and their families. *Journal of Patient Safety, 00*(00), 1-6. https://doi.org/10.1097/PTS.0000000000000290

Schwappach, D.L., Frank, O. & Davis, R.E. (2013). A vignette study to examine health care professionals' attitudes towards patient involvement in error prevention. *Journal of Evaluation in Clinical Practice, 19*(5), 840–848. https://doi.org/10.1111/j.1365-2753.2012.01861.x

Sedman, A., Harris, J. M., II, Schultz, K., Schwalenstocker, E., Remus, D., Scanlon, M., & Bahl. V. (2005). Relevance of the Agency for Healthcare Research and Quality Patient Safety Indicators for children's hospitals. *Pediatrics, 115*(1), 135-145. https://doi.org/10.1542/peds.2004-1083

Shatzman, L. (1991). Dimensional analysis: notes on an alternative approach to the grounding of theory in qualitative research. In D. R. Maines ed., *Social Organization and Social Process. Essays in Honor of Anselm Strauss.* New York: Aldine De Gruyter.

Shever, L .L., Titler, M., Dochterman, J., Fei, Q., & Picone, D. M. (2007). Patterns of nursing intervention use across 6 days of acute care hospitalization for three older patient populations. *International Journal of Nursing Terminologies and Classification, 18*(1), 18-29. https://doi.org/10.1111/j.1744-618X.2007.00044.x

Slonim, A. D., LaFleur, B. J., Ahmed, W., & Joseph, J. G. (2003). Hospital-reported medical errors in children. *Pediatrics*, *111*(3), 617-621. https://doi.org/10.1542/peds.111.3.617

Stockwell, D. C., Landrigan, C. P., Toomey, S. L., Loren, S. S., Jang, J., Ashrafzadeh, S.,…Schuster, M. A. (2018). Adverse events in hospitalized pediatric patients. *Pediatrics, 142*(2), 1-14. https://doi.org/10.1542/peds.2017-3360

The Joint Commission. (2018). Facts about speak up™. Retrieved from https://www.jointcommission.org/facts_about_speak_up/

Tibballs, J., Kinney, S., Duke, T., Oakley, E., & Hennessy, M. (2005). Reduction of paediatric in-patient cardiac arrest and death with a medical emergency team: preliminary results. A*rchives of Disease in Childhood, 90*(11), 1148-1152. https://doi.org/10.1136/adc.2004.069401

Tume, L. (2007). The deterioration of children in ward areas in a specialist children's hospital. *Nursing in Critical Care, 12*(1), 12-19. https://doi.org/10.1111/j.1478-5153.2006.00195.x

Tume, L. N., Sefton, G., & Arrowsmith, P. (2014). Teaching paediatric ward teams to recognize and manage the deteriorating child. *Nursing in Critical Care, 19*, 196-203. https://doi.org/10.1111/nicc.12050

Ygge, B. M., & Arnetz, J. E. (2004). A study of parental involvement in pediatric hospital care: Implications for clinical practice. *Journal of Pediatric Nursing, 19*(3), 217-223. https://doi.org/10.1016/j.pedn.2004.02.005

Zenker, P., Schlesinger, A., Hauck, M., Spencer, S., Hellmich, T., Finkelstein, M.,… Billman, G. (2007). Implementation and impact of a rapid response team in a children's hospital. *The Joint Commission Journal on Quality and Patient Safety, 33*(7), 418-425. https://doi.org/10.1016/S1553-7250(07)33048-1

CHAPTER FIVE

SYNTHESIS

JAMES R. STOTTS

Synthesis

Children experience harm while being treated in the hospital from medical error or physiologic deterioration (Knudson et al., 2012; Stockwell et al., 2018). Process improvement efforts to prevent harm in hospitalized children have focused on early detection of precursor conditions and clinical instability as well as strategies to provide early, rapid, and effective treatment (Brady et al., 2013; Hayes et al., 2012; Van der Jagt, 2013). Education programs designed to improve recognition and treatment of deterioration, and implementation of early warning and emergency response systems demonstrate improved knowledge and situation awareness, and appear to decrease patient morbidity and mortality (Brady & Goldenhar, 2014; Bonafide et al., 2014; Martin, Keller, Long, & Ryan-Wenger, 2016; Sefton et al., 2015).

Despite these advances, up to 19% of clinical deterioration events can be attributed to suboptimal care such as delays in recognition or escalation (Hayes et al., 2012). It is well established that individual characteristics, interpersonal dynamics, and organizational factors moderate surveillance efficacy and rescue outcomes in adults, even if early warning and rapid response systems are in place (Arora et al., 2016; Wood, Chaboyer, & Carr, 2019). Factors that mitigate surveillance outcomes in patients on pediatric acute care units, though less well researched, indicate similar results (Azzopardi, Kinney, Moulden, & Tibballs, 2011; Brady & Goldenhar, 2014; Brady et al., 2013; Hayes et al., 2012; Joffe, Anton, & Burkholder, 2011) but with gaps that warrant further investigation.

The studies presented in this dissertation were aimed at exploring the concept of nursing surveillance of clinical deterioration in pediatric patients in acute care settings. Nursing surveillance was chosen as a conceptual framework to study because it is a predominant nursing activity (Shever et al., 2007), and as such has significant potential to reduce patient harm. This

context was chosen because there is a lack of evidentiary data specific to pediatric acute care nursing about factors that ameliorate surveillance to guide process improvement implementation. Four questions were explored: (a) What factors influence nursing actions associated with surveillance of unstable patients? (b) What nursing actions comprise surveillance and responding to patient deterioration? (c) What social interactions impact the quality of surveillance? and (d) What gaps remain in our understanding of nursing surveillance of pediatric patients?

Factors that Facilitate or Hinder Nursing Surveillance of Unstable Patients

Current models of nursing surveillance show relationships between aspects of the practice environment such as organizational support for nursing and resources, characteristics of clinicians such as education, skill, and experience, the patient, and patient outcomes (Aiken, Clarke, & Sloane, 2002; Kutney-Lee, Lake, & Aiken, 2009; Kelly & D. Vincent, 2011). These conceptual translations do not include sufficient detail to evaluate directional impact of individual model components, nor the nuances of factors that affect nursing surveillance of pediatric patients. Consequently a socio-technical systems framework by Karsh, Holden, Alper, and Or (2006) and Bronfenbrenner's (1977) socioecological theory of child development and adaptation were used to inform a search for factors associated with nursing surveillance and deterioration. This new model (figure 5.1) incorporates actions described in definitions of nursing surveillance which includes acquisition, interpretation, and synthesis of patient data, and decision making about threats to safety and treatment responses (Bulechek, Butcher, Dochterman, & Wagner, 2013; Kelly & Vincent, 2011; Meyer, Lavin, & Perry, 2007).

A review of original research that addressed any aspect of surveillance activities performed by nurses or contributing factors to nursing surveillance in noncritical care areas was conducted (see chapter 2 for search methodology). This review confirmed that similar factors

influence nursing surveillance of acute care pediatric patients as had been previously described in other patient populations (Tables 5.1 and 5.2). A number of additional factors were identified which were described in chapters 3 and 4. Forty-one specific conditional characteristics of the patient, family, nurse, team, unit, and organization were identified. In addition, two cognitive activities, 8 technology interfaces, and 13 social interactions were described. These included factors such as parent presence, patient acuity, nurse knowledge, skill and experience, unit layout, availability of functional equipment, and communication practices and norms. This comprehensive analysis, however; was the first to collate this data on socio-technical factors that affects nursing surveillance of pediatric patients.

A few individual and organizational factors are worth noting as original contributions to our understanding of surveillance: administrative/clinical leader support, resilience, and parent surveillance behaviors. Providing resources and focus on structures that support a safety culture is the role of administrative and clinical leaders. Structures such as implementation of an RRS, opportunities for interdisciplinary training, processes for identifying and communicating about patient risk, multidisciplinary planning for contingencies and continuity of care, and strategies for enhancing nurse empowerment have been identified as important to risk reduction via supporting nurse surveillance (Brady & Goldenhar, 2014; Trasher et al., 2017). This dissertation's new contributions to structures supporting surveillance include electronic equipment that organizes patient data to highlight risk, accessibility of equipment and supplies, and work flow changes that reduce distractions and competing demands as other processes administrative and clinical leaders should attend to in order to facilitate surveillance and promote safety culture.

Resilience is the ability to anticipate and adapt to hazards in order to resume core functions (Fairbanks, Wears, Woods, Hollnagel, Plsek, & Cooks, 2014; Sherman et al., 2009). In this set of studies, nurses demonstrated abilities to negotiate, collaborate, and adapt surveillance activities to include parents, integrate with parents, use multiple sources for data collection, vary strategies to temporize clinical instability and maintain surveillance, and escalate care. These nurse level actions and factors contributed to nursing resilience in the face of potential clinical deterioration. Organizational resilience was enhanced by processes that supported nurses' summoning assistance, and flexibility of nurses to adjust assignments based on changing patient acuity.

Lastly, this dissertation highlighted specific behaviors of parents that facilitate and hinder surveillance. These included acquiring patient data, helping nurses to interpret condition changes, and make decisions about treatment actions. Studies had previously described the varied role of parents in maintaining presence, and caring for and watching over their child while in the hospital.

The explanatory matrix that guided analysis of the data described in chapter 3 provides an original conceptual framework for relationships among factors that influence nursing surveillance.

Nursing Actions during Surveillance

The definition of nursing surveillance provided a broad context for exploring what nurses do when they are acquiring, interpreting, and synthesizing patient data to decide on whether a safety threat exists and what to do about it. A review of the literature on pediatric surveillance provided limited additional explanation of these nursing actions. In this review, performing and documenting assessments were identified as foundational for recognizing deterioration and

marshalling support for intervention. Decision making was used to determine when and how to monitor patients, how to intervene, and whether to call for help. Nurses communicated changes in patient condition and intervened by marshalling resources, increasing assessment frequency, adding electronic monitoring, and consulting with other clinicians. What and how nurses assess, how they make decisions, how they communicate, and how they intervene were not fully explored.

The study described in chapter 3 demonstrated that nurses engage in 6 key activities during surveillance: establishing a baseline, anticipating risk, noticing, evaluating, managing, and escalating. Additional detail about what nurses do during these activities was also described. The study in chapter 4 described 3 additional activities which included collaborating, negotiating, and adapting focused on integrating the nurse and parent roles in patient surveillance. Table 5.3 aligns the activities described in chapter 2, 3, and 4 with the aspects of the current definition of nursing surveillance.

The activities described in the result sections of chapter 3 and 4 are new contributions to the science of nursing surveillance in that they specifically detail what pediatric nurses do during surveillance. Critics however, may claim this data is simply a re-work of previously established information, and indeed there is some prudence to these assertions. When reviewing literature about surveillance in general, across patient populations, one is exposed to several concepts that describe cognitive, social, and behavioral aspects of surveillance. These include concepts such as vigilance, situation awareness, clinical grasp, intuition, agency, decision making, critical thinking, attentiveness, diagnostic or clinical reasoning, and escalation (Benner et al,; 2006; Busby & Witucki-Brown, 2011; Coiffi, 2001; Endsley, 1995; Evans, 1990, Johnston, Arora, King, Stroman, & Darzi, 2014; Jones & Endsley, 2000; Klaver & Baart, 2011; Lyndon &

Kennedy, 2010). Each of these concepts are a part of surveillance, but do not represent its totality. Likewise surveillance activities have been described in other patient populations, and non-research based publications (Chua, Mackey, Ng, & Liaw, 2013; Gephart, McGrath, & Effken, 2011; Odell, Victor, & Oliver, 2009). This is the first empirically-based study that describes the activities of nursing surveillance of pediatric patients.

Three surveillance activities require additional comment. Noticing changes in patient stability was described as a process contingent on a confluence of sensory inputs and cognitive activities. In some situations, however the trigger for noticing was attributed to intuition. In nurses' accounts, the senses initially detected a noteworthy sign, symptom or situation. These were described as something that was just slightly off or unusual; conditions that, in most cases, might not have prompted concern or additional investigation, in part because they were expected variants of each particular patient's constellation of signs and symptoms. Examples included a cough, a slightly faster respiratory rate, a child who was alone in a room, smacking of the lips, or a change in interaction. In each of these cases the nurses paused. They had a feeling, an inkling, a concern which they noted as something to watch or to investigate. According to Benner, Kyriakidis, and Stannard (2011) intuitive grasp of a situation does not require thinking or awareness, but is based on pattern recognition of similar and dissimilar situations (p. 556). In each of the examples above, the nurses made reference to having 'seen this before', or 'it can happen with kids like this', which may have provided the context for recognizing a change. The subsequent cognitive work of clinical grasp of a situation, according to Benner, Kyriakidis, and Stannard (2011) involves making qualitative distinctions of patient data based on context, patient history, and the situation, engage in contemporaneous clinical reasoning, and determine clinical relevance as a situation.

Current definitions of nursing surveillance describes actions on a continuum from assessing to decision making. This dissertation extends the definition of surveillance to include the initial management of a patient's changing condition and escalation. This reflects descriptions by nurses of surveillance actions in the situation of clinical instability that includes the concurrent escalation, and short trials of interventions to ameliorate signs or symptoms co-mingled with re-assessment, interpretation, synthesis and decision making. In some cases more intense or frequent surveillance is implemented as a therapeutic measure, which blurs the delineation between when surveillance as a process of data gathering and decision making end and intervention begins. Indeed, *surveillance as an intervention* has been shown to positively impact patient outcomes (Kutney-Lee, Lake, & Aiken, 2009; Shever, 2011).

Other sources conflate intervention with surveillance. Kelly and Vincent (2011) identified intervention as an attribute of nursing surveillance in a conceptual analysis of surveillance in the acute care setting. Kutney-Lee, Lake, and Aiken (2009) described nursing surveillance as an intervention in their development of the concept of nurse surveillance capacity. Henneman, Gawlinski, and Guiliano (2012) explained nursing surveillance as a process that includes identifying risk and potential adverse events, and identifying, preventing and recovering (including implementing corrective actions) from medical error.

As part of processes to improve recognition of clinical instability and reduce adverse events, surveillance and management are often tightly coupled within track and trigger tools. Response algorithms and guidelines instruct nurses to alter surveillance intensity, escalate, and in some cases institute treatments based on surveillance findings (Dean, Fenix, Spaeder, & Levin, 2017; Shields, Wiesner, Klein, Pelletreau, & Hedriana, 2016). Surveillance schemas without actionable guidelines creates a system defect that may cause treatment delays and adverse

consequences (Smith, Sekhon, Francis, & Aitken, 2019). In one setting, coupling surveillance with mitigation plans reduced transfers to the ICU and adverse events (Brady et al, 2013).

Social Interactions that Impact Surveillance Quality

Social interactions of importance to surveillance were identified as those with physicians and parents. With physicians, issues related to communication, teamwork, accountability, hierarchy, and escalation were described; while with parents the issues centered on communication about patient condition, engagement in patient care, and the parents role in surveillance activities.

The study described in chapter 4 is the first to specifically address the phenomenon of integrating nurse and parent roles in pediatric patient surveillance through an explanatory matrix. The perspectives of parents to advocate for their child and to maintain decision autonomy were at times mutually consistent, or in conflict, with the perspective of nurses to maintain accountability, to execute the plan of care, validate assessments, and uphold care standards. As with previous research, parents activities centered on providing care to their child, both daily and nursing, and maintaining a watchful eye over care delivery (Power & Franck, 2008). Role integration in surveillance required negotiation, collaboration, and adaptation between nurses and parents. This required establishing mutual surveillance indices and goals, joint planning and decision making for how assessments occurred, treatments were administered, and patients were monitored.

A surprising finding was the difference in perceptions between parents and nurses about parent involvement in aspects of nursing surveillance and accounts of failures in surveillance. Parents provided accounts of their activities in all facets of nursing surveillance. Nurses on the other hand provided numerous accounts of parents assisting with acquisition and interpretation of

patient data, but much less in data synthesis, determining threats, and decision making about intervention. Though most parents were complimentary about the nursing care their child received many could relay examples of failures in nursing care, some resulting in potential patient harm. Nurses, conversely, did not provide narratives about adverse events associated with their nursing care.

This paper expanded our understanding the how nursing surveillance activities change as a result of integrating roles with parents. The addition of parents in the process of care delivery significantly alters the activities of surveillance. This paper highlights ways in which integration of roles is an asset and a barrier to surveillance, and provides strategies used by nurses to utilize the benefits, and circumvent or minimize impeding influences.

Significance

This dissertation has explored and further defined the actions of nursing surveillance and its' facilitators and barriers. These findings have described in greater detail than in previous studies how some of these factors influence surveillance which gives direction for process improvement, decision making and allocation of resources, and points to topics for education and training. It also suggests strategies for increasing redundancy in processes for cross-checking patient data and communicating patient instability, promoting anticipatory planning, and fostering interdisciplinary collaboration thereby creating a safer work culture. In addition this dissertation has expanded our knowledge of how the roles of nurses and parents in patient surveillance are integrated. It has pointed out conditions that both enhance and hinder nurse and parent integration, processes involved in integration, and their potential consequences, providing guidance for anticipation, prevention, and mitigation of conflicts.

Implications for Research and Practice

Much of the research in the area of surveillance has focused on predictive models for physiologic demise, efficacy of early warning trigger tools, and the impact of rapid response systems. There is little research on scouting processes as a surveillance mechanism to look after patients who are identified as a potential risk (e.g., transfers from the ICU, first day post-operative patients).

Findings from the integrative review and the study on facilitators and barriers to pediatric nursing surveillance are commensurate with previous studies in other patient populations (Gazarian, Henneman, &Chandler, 2010; Gawronski et al., 2018; Hickey, Gauvreau, Curley, & Connor, 2013). These findings can be used to develop and implement programs to improve surveillance and spawn research to evaluate program efficacy.

More research is needed to understand how nurses and physicians interact during times of evaluation and management of unstable patients. Andrews and Waterman (2005) found differences between nurses and physicians in how they describe and appraise deterioration. Nurses in this dissertation study conveyed difficulty with aligning their perspectives with those of physicians regarding calling the RRS, treatment goals, and interventions including transfer to a higher level of care. Most studies evaluating team performance in the care of pediatric patients have focused on emergency situations in the ICU or emergency department (Bultras, Hassler, Ercole, & Rea, 2014; Messmer, 2008; Patterson, Geis, LeMaster, & Wears, 2013; Thomas et al., 2007; Weinstock et al., 2005). Team performance of acute care based pediatric clinicians, including ancillary staff, has not been evaluated. A mixed method study could be used to explore how physicians and nurses communicate and justify concern using interview, observation, and case studies.

How nurses assess for instability and make decisions about interventions are other areas in need of research. The literature does not fully describe these processes or influencing factors when evaluating a deteriorating patient or deciding among treatments options. This could have been explored more fully in the interviews of nurses in the present study by asking what cues represented deterioration, how they evaluated deterioration, and how they made decisions on further investigation or management, though this was not the main focus of the study. This could be explored more fully using a qualitative study format asking nurses to relate assessment and management actions based on past experiences, direct observation, or asking nurses to think-out-loud during analysis of case studies (Twycross, & Powls, 2006).

The study in chapter 4 provided preliminary insights into the integration of roles in surveillance between nurses and parents. Parents had difficulty in understanding the concept of surveillance and how to evaluate the influencers of this process. Parents delineated concerns for safety (e.g. medical errors), variation in clinical practices, and discontinuity in communication and care planning as reasons for their increased surveillance behaviors which sometimes interfered with the nurse's ability to monitor the patient and execute treatment. Developing mechanisms for parents to voice concerns, discuss distressing observations and experiences, and participate in care planning with nurses and physicians would facilitate shared treatment planning and problem solving.

The explanatory model presented in chapter 4 begins to explain the phenomenon of parent and role integration during surveillance. More research is needed to explore strategies to reduce parent stress associated with the hospital environment, how to increase parent confidence in safety surveillance and speaking up, how to foster team performance of the nurse, physician and parent triad.

Conclusion

Much emphasis has been put on the afferent side of rapid response system work: the identification of patients at risk and recognition of pending instability. This has led to a number of early warning trigger tools and criteria for calling when deterioration is recognize. However a recent review of how nurses use warning criteria suggest socio-technical system factors interfere with the efficacy of these tools.

The focus of this dissertation was on, to paraphrase a quote from Leonard Schatzman 'what all is going on here' (Schatzman, 1991), or the system and human factors that influence recognition and management of instability. This goal was achieve by 1) synthesizing the current literature to understand the gaps in knowledge; and 2) conducting a study to further flesh out what nurses do during surveillance for condition changes, better understand the facilitators and barriers to nursing surveillance, and explore the interaction between parents and nurses during surveillance of hospitalized children. Finally, we provided recommendations for clinical application of the findings and areas for further research. Recommendations for practice include factors to consider for making improvements in surveillance processes and suggested ways to decrease the stress of hospitalization for parents and facilitate coordination or surveillance efforts between nurses and parents. Areas in need of further research include exploration of how nurses and physicians evaluate and communicate about patient instability and further exploration of factors that facilitate role integration of nurses and parents during patient surveillance.

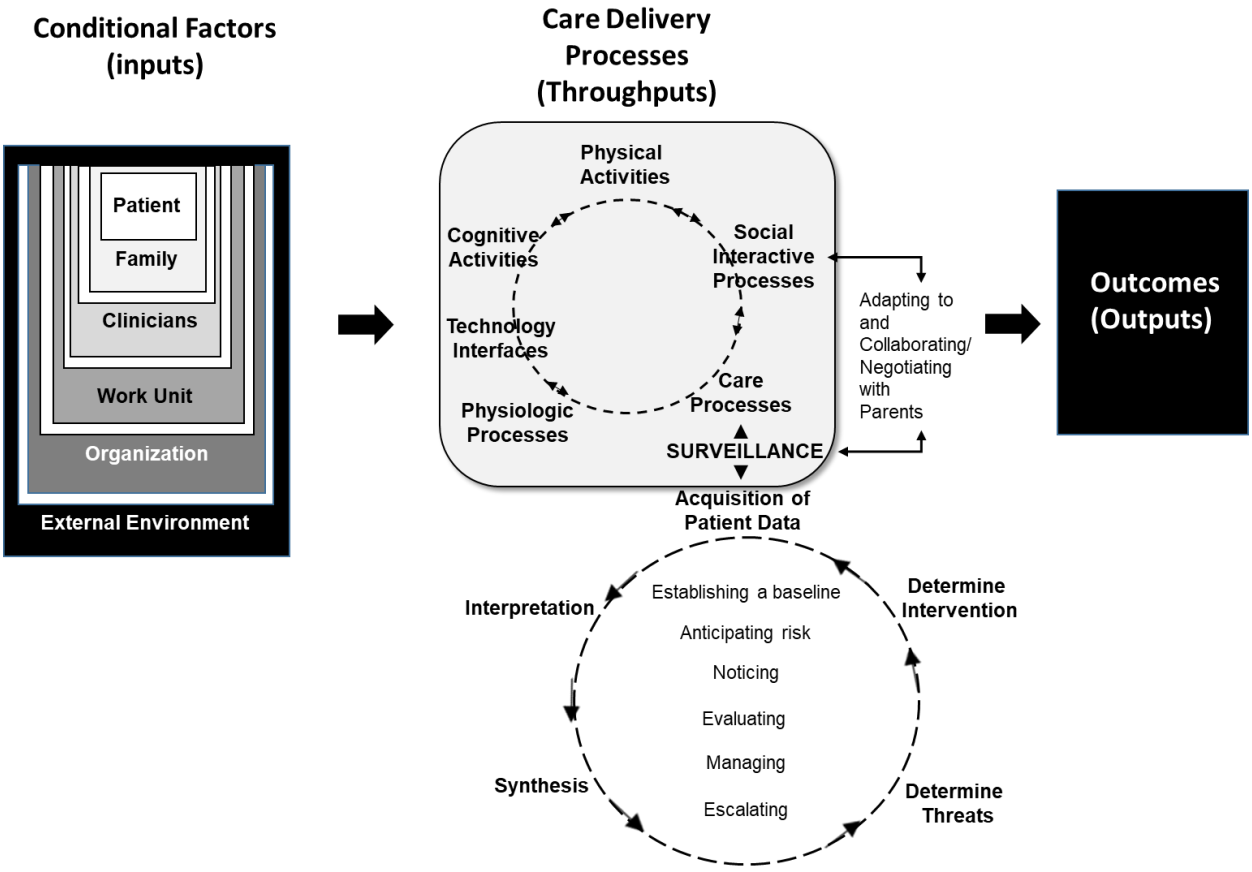

Figure 5.1
Theoretical model of surveillance

Note:. Model is depicts in a socio-technical system framework. Conditional factors (inputs) to care delivery include characteristics of the family, patient, clinician, work unit, organization and external environment. Activities and interactions of and between people, the enviroment, and technology comprise the clinical care arena and impact care delivery processes (throughputs). Surveillance is an aspect of care delivery that involves patient data acquistion, interpretation and synthesis and decision making about threats to health and safety and intervention. During surveillance, nurses engage in specific activities: establishing a baseline, anticipating risk, noticing, evaluating, managing, and escalating. Adapted from "A human factors engineering paradigm for patient safety: Designing to support the performance of the healthcare professional," by B. T. Karsh, R. J. Holden, S. J. Alper, and C.K. Or, 2006, *Quality and Safety in Health Care, 15,* i61.

Table 5.1

Facilitators of Nursing Surveillance of Pediatric Patients

Chapter 2: Integrative Review	Chapter 3: Data Paper 1	Chapter 4: Data Paper 2
▪ Patient Characteristics – increased morbidity – increased acuity – surgical patients ▪ Family Characteristics – parent availability ▪ Nurse Characteristics – experience – intuition/ gut feeling – education – confidence – self-efficacy – assertive – situation awareness ▪ Team Characteristics – shared language of risk and indicators – standardized assessment method/ treatment guidelines – support structures for handoff/ continuity/contingency planning – established relationships between clinicians – joint learning and training between clinician groups – situation awareness ▪ Unit Characteristics – adequate staffing – low nurse to patient ratio – culture of reporting – managerial support ▪ Environment Characteristics – equipment availability – electronic medical record for data trending ▪ Organizational Characteristics – implementation of RRS – implementation of PEWS – implementation of process for family to initiate RRS ▪ External Environment – Joint Commission requirement to implement RRS – national/international PEWS implementation of as best practice	▪ Family Characteristics – families who were knowledgeable about their child's care, medications, and reactions to treatments ▪ Nurse Characteristics – resilience – comprehensive and accurate information in handoff report ▪ Team Characteristics – being approachable – being available and in proximity of each other – bedside rounding ▪ Unit Characteristics – administrative and Clinical leadership support for team training, multidisciplinary communication, respectful listening, equipment/supply accessibility – redundant alert and alarming systems – EMR with nursing information assembled for easy access – resilience ▪ Organizational Characteristics – policy and procedures for CPR, RRS	▪ Family Characteristics – parent engagement in surveillance ▪ Nurse Characteristics – ability to negotiate, collaborate, and adapt surveillance activities to include parents

Note: CPR = cardiopulmonary resuscitation; EMR = electronic medical record; ICU = intensive care unit; MD = medical doctor; PEWS = pediatric early warning score; RN = registered nurse; RRS = rapid response system

Table 5.2

Barriers to Nursing Surveillance of Pediatric Patients

Chapter 2: Integrative Review	Chapter 3: Data Paper 1	Chapter 4: Data Paper 2
▪ Team Characteristics – not being listened to by providers – perceived hierarchy – inexperienced providers in pediatric care – lack of experienced clinical resources for consultation – previous negative encounters with MD – lack of team work between physicians – fear of criticism when escalating – lack of trust between practitioners – expectations/ desire to treat patient on the floor instead of transferring – indirect interface between clinicians d/t geography/ phone/ text messaging – Having to convince providers to evaluate or treat – loss of control over patient when calling RRS or with transferring ▪ Unit Characteristics – lack of resources if patient deteriorates – staffing mix – lack of RN empowerment ▪ Environment Characteristics – shift work/ duration and change in assignments impacting continuity of care – decreased resources on off shifts – documentation in different places in the EMR – rushed encounters/ work pressure – distractions – documentation demands/ time – lack of beds in ICU – equipment not working or not available	▪ Patient Characteristics – patients without parent presence – frequent calls ▪ Family Characteristics – parents who censored when nurses could perform work tasks – parents who completed nursing care without communicating findings – Frequency calls ▪ Team Characteristics – lack of closed loop communication such as can occur with texting or placing orders in EMR – trials of intervention – multi-tiered escalation process ▪ Unit Characteristics – unit layout ▪ Environment Characteristics – unfamiliarity with patient population as a consequence of floating – equipment artifact – inaccurate or complex paging process	▪ Family Characteristics – maladaptive parent coping with stress from their child's hospitalization – lack of integration of surveillance activities between nurses and parents resulting in misaligned expectations and goals

Note: CPR = cardiopulmonary resuscitation; EMR = electronic medical record; ICU = intensive care unit; MD = medical doctor; PEWS = pediatric early warning score; RN = registered nurse; RRS = rapid response system

Table 5.3
Nursing Actions Associated with Surveillance

Surveillance Definition	Chapter 2: Integrative Review	Chapter 3: Data Paper 1	Chapter 4: Data Paper 2
Acquisition of data	▪ Assessing ▪ Documentation	▪ Establishing a baseline (based on handoff, EMR, bedside rounding, consulting with other clinicians and parents) ▪ Noticing (based on intuition, information from parents, electronic surveillance) – assessment to investigate ▪ Evaluating – intensify monitoring – administer interventions for symptomatic relief – increase frequency and duration of monitoring – position patient closer to nurses for closer monitoring – trend and quantify data – increase frequency of assessments – validate findings with others	▪ Collaborating/ negotiating with parents ▪ Adapting to lack of parents
Interpretation of data	▪ Assessing ▪ Documentation ▪ Communication about changes	▪ Anticipating risk (based on knowledge, experience, PEWS, parent information) – adjusting patient assignments – discussing patient concerns at rounds, huddles, clinician resource meetings – set up emergency equipment – assure/establish IV access ▪ Noticing (based on intuition, information from parents, electronic surveillance) – assessment to investigate ▪ Evaluating – intensify monitoring – administer interventions for symptomatic relief – increase frequency and duration of monitoring – position patient closer to nurses for closer monitoring – trend and quantify data – increase frequency of assessments – validate findings with others	▪ Collaborating with parents

Note: Nursing actions identified in dissertation chapters associated with phases of surveillance. EMR = electronic medical record; ICU = intensive care unit; IV = intravenous; MD = medical doctor; PEWS = pediatric early warning score; RN = registered nurse; RRS = rapid response system; RT = Respiratory Therapist

(continued)

Surveillance Definition	Chapter 2: Integrative Review	Chapter 3: Data Paper 1	Chapter 4: Data Paper 2
Synthesis of data		▪ Evaluating – intensify monitoring – administer interventions for symptomatic relief – increase frequency and duration of monitoring – position patient closer to nurses for closer monitoring – trend and quantify data – increase frequency of assessments – validate findings with others	▪ Collaborating with parents
Determining threats to health and safety	▪ Assessing ▪ Communication about changes ▪ Decision making	▪ Anticipating risk (based on knowledge, experience, PEWS, parent information) – adjusting patient assignments – discussing patient concerns at rounds, huddles, clinician resource meetings – set up emergency equipment – assure/establish IV access ▪ Evaluating – intensify monitoring – administer interventions for symptomatic relief – increase frequency and duration of monitoring – position patient closer to nurses for closer monitoring – trend and quantify data – increase frequency of assessments – validate findings with others	▪ Collaborating with parents ▪ Adapting to lack of parents

Note: Nursing actions identified in dissertation chapters associated with phases of surveillance. EMR = electronic medical record; ICU = intensive care unit; IV = intravenous; MD = medical doctor; PEWS = pediatric early warning score; RN = registered nurse; RRS = rapid response system; RT = Respiratory Therapist

(continued)

Surveillance Definition	Chapter 2: Integrative Review	Chapter 3: Data Paper 1	Chapter 4: Data Paper 2
Determining interventions	▪ Assessing ▪ Decision making ▪ Communication about changes ▪ Intervening – marshalling resources – more frequent assessments – electronic monitoring – consulting with other clinicians – activating RRS	▪ Evaluating – intensify monitoring – administer interventions for symptomatic relief – increase frequency and duration of monitoring – position patient closer to nurses for closer monitoring – trend and quantify data – increase frequency of assessments – validate findings with others ▪ Managing – reposition body or head – adjust oxygen – assist patient to cough and deep breath – establish IV access – administer of rescue or symptom relieving medications – marshalling resources – institute physiologic monitoring – bring equipment and supplies into patient room – prepare for acquiring anticipated lab tests – consult with RT, radiology, pharmacists for needed procedures/treatments – confer with ICU about beds – prepare ICU for transfer – consult with other clinicians ▪ Escalating – validate findings with other RNs – triage tasks to other nurses – escalate to junior then senior clinicians – assist MD with intervention trials – call RRS	▪ Collaborating/ Negotiating with parents ▪ Adapting to lack of parents

Note: Nursing actions identified in dissertation chapters associated with phases of surveillance. EMR = electronic medical record; ICU = intensive care unit; IV = intravenous; MD = medical doctor; PEWS = pediatric early warning score; RN = registered nurse; RRS = rapid response system; RT = Respiratory Therapist

References

Aiken, L. H., Clarke, S. P., & Sloane, D. M. (2002). Hospital staffing, organization, and quality of care: Cross-national findings. *Nursing Outlook, 50*(5), 187-94. https://doi.org/10.1067/mno.2002.126696

Andrews, T., & Waterman, H. (2005). Packaging: A grounded theory of how to report physiological deterioration effectively. *Journal of Advanced Nursing, 52*(5), 473-481. https://doi.org/10.111/j.1365-2648.2005.03615.x

Arora, L. S., Shields, L. E., Grobman, W. A., D'Alton, M. E., Lappen, J. R., & Mercer, B. M. (2016). Triggers, bundles, protocols, and checklists – what every maternal care provider needs to know. *American Journal of Obstetrics & Gynecology, 214*(4), 444-451. https://doi.org/10.1016/j.ajog.2015.10.011

Azzopardi, P., Kinney, S., Moulden, A., & Tibballs, J. (2011). Attitudes and barriers to a medical emergency team system at a tertiary paediatric hospital. *Resuscitation, 82*(2), 167-174. https://doi.org/10.1016/j.resuscitation.2010.10.013

Benner, P., Kyriakidis, P. H., & Stannard, D. (2011). *Clinical Wisdom and Interventions in Acute and Critical Care. A Thinking-in-Action Approach* (2nd ed.). New York, NY: Springer.

Benner, P., Malloch, K., Sheets, V., Bitz, K., Emrich, L., Thomas, M. B.,...Farrell, M. (2006). TERCAP: Creating a national database on nursing errors. *Harvard Health Policy Review, 7*(1), 48-63.

Bonafide, C. P., Localio, A. R., Roberts, K. E., Nadkarni, V. M., Weirich, C. M., & Keren, R. (2014). Impact of rapid response system implementation on critical deterioration events in children. *JAMA Pediatrics, 168*(1), 25-33. https://doi.org/10.1001/jamapediatrics.2013.3266.

Brady, P. W., & Goldenhar, L. M. (2014). A qualitative study examining the influences on situation awareness and the identification, mitigation and escalation of recognised patient risk. *BMJ Quality & Safety, 23*(2), 153-161. https://doi.org/10.1136/bmjqs-2012-001747

Brady, P. W., Muething, S., Kotagal, U., Ashby, M., Gallagher, R., Hall, D.,…Wheeler, D. S. (2013). Improving situation awareness to reduce unrecognized clinical deterioration and serious safety events. *Pediatrics, 131*(1), e298-e308. https://doi.org/10.1542/peds.2012-1364

Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist, 32,* 513-531.

Bultras, M. W., Hassler, M., Ercole, P. M., & Rea, G. (2014). Effectiveness of high-fidelity simulation for pediatric staff nurse education. *Pediatric Nursing, 40*(1), 27-42.

Busby, S., & Witucki-Brown, J. (2011). Theory development for situational awareness in multi-casualty incidents. *Journal of Emergency Nursing, 37*(5), 444-452. https://doi.org/10.1016/j.jen.2010.07.023

Bulechek, G. M., Butcher, H., Dochterman, J. M., & Wagner, C. M. (2013). *Nursing interventions classification (NIC;* 6th ed.). St. Louis, MO: Elsevier.

Cioffi, J. (2001). A study of the use of past experiences in clinical decision making in emergency situations. *International Journal of Nursing Studies, 38*(5), 591-599. https://doi.org/10.1016/S0020-7489(00)00096-1

Chua, W. L., Mackey, S., Ng, E. K. C., Liaw, S. Y. (2013). Front line nurses' experiences with deteriorating ward patients: a qualitative study. *International Nursing Review, 60*(6), 501-509. https://doi.org/10.1111/inr.12061

Dean, N. P., Fenix, J. B., Spaeder, M., Levin, A. (2017). Evaluation of a pediatric early warning score across different subspecialty patients. *Pediatric Critical Care Medicine, 18*(7), 655-660. https://doi.org/10.1097/PCC.0000000000001176

Endsley, M. (1995). Measurement of situational awareness in dynamic systems. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 37*(32), 65-84. https://doi.org/10.1518/001872095779049543

Evans, D. (1990). Problems in the decision making process: a review. *Intensive Care Nursing, 6*(4), 179-184. https://doi.org/10.1016/0266-612X(90)90019-4

Fairbanks, R. J., Wears, R. L., Woods, D. D., Hollnagel, E., Plsek, P., & Cook, R. I. (2014). Resilience and resilience engineering in health care. *The Joint Commission Journal of Quality and Patient Safety, 40,* 376-383.

Gazarian, P. K., Henneman, E. A., & Chandler, G. E. (2010). Nurse decision making in the prearrest period. *Clinical Nursing Research, 19*(1), 21-37. https://doi.org/10.177/1054773809353161

Gawronski, O., Parshuran, C., Cecchetti, C., Tiozzo, E., Coife degli Atti, M.L., Dall-Oglio, I., Scarselletta, G.,...Latour, J.M. (2018). Qualitative study exploring factors influencing escalation of care of deteriorating children in a children's hospital. *BMJ Paediatrics Open, 2*(1), e000241. httsp://doi.org/10.1136/bmjpo-2017-000241.

Gephart, S. M., McGrath, J. M., Effken, J. (2011). Failure to rescue in neonatal care. *Journal of Neonatal Nursing, 25*(3), 275-282. https://doi.org/10.1097/JPN.ob013e318227cc03

Hayes, L. W., Dobyns, E. L., DiGiovine, B., Brown, A. M., Jacobson, S., Randall, K. H.,…Markovitz, B. (2012). A multicenter collaborative approach to reducing pediatric codes outside the ICU. *Pediatrics, 129*(3), e785-e791. https://doi.org/10.1542/peds.2011-0227

Henneman, E. A., Gawlinski, A., & Giuliano, K. K. (2012). Surveillance: A strategy for improving patient safety in acute and critical care units. *Critical Care Nurse, 32*(2), e9-e18. https://doi.org/10.4037/ccn2012166

Hickey, P. A., Gauvreau, K., Curley, M. A., & Connor, J. A. (2013). The effect of critical care nursing and organizational characteristics on pediatric cardiac surgery mortality in the United States. *Journal of Nursing Administration, 43*(12), 637-644. https://doi.org/10.1097/NNA.0000000000000005

Joffe, A. R., Anton, N. R., & Burkholder, S. C. (2011). Reduction in hospital mortality over time in a hospital without a pediatric medical emergency team: Limitations of before-and-after study designs. *Archives of Pediatric and Adolescent Medicine, 165*(5), 419-423. https://doi.org/10.1001/archpediatrics,2011.47

Johnston, M., Arora, S., King, D., Stroman, L., & Darzi, A. (2014). Escalation of care and failure to rescue: A multicenter, multiprofessional qualitative study. *Surgery, 155*(6), 989-994. https://doi.org/10.1016/j.surg..2014.01.016

Jones, D. G., & Endsley, M. R. (2000). Overcoming representational errors in complex environments. *Human Factors: The Journal of the Human Factors and Ergonomics Society, 42*(3), 367-378. https://doi.org/10.1518/001872000779698187

Karsh, B. T., Holden, R. J., Alper, S. J., & Or., C.K. (2006). A human factors engineering paradigm for patient safety: Designing to support the performance of the healthcare professional. *Quality and Safety in Health Care, 15*(Suppl. 1), i59-i65. https://doi.org/10.1136/qshc.2005.015974

Klaver, K., & Baart, A. (2011). Attentiveness in care: towards a theoretical framework. *Nursing Ethics, 18*(5), 686-693. https://doi.org/10.1177/0969733011408052

Knudson, J. D., Neish, S. R., Cabrera, A. G., Lowry, A. W., Shamszad, P., Morales, D. L., Graves, D. E.,…Rossano, J. W. (2012). *Critical Care Medicine, 40*(11), 2940-2944. https://doi: 10.1097/CCM.0b013e31825feb3f

Kelly, L., & Vincent, D. (2011). The dimensions of nursing surveillance: A conceptual analysis. *Journal of Advanced Nursing, 67*(3), 652-661. https://doi.org/10.1111/j.1365-2648.2010.05525.x

Kutney-Lee, A., Lake, E .T., & Aiken, L .H. (2009). Development of the hospital nurse surveillance capacity profile. *Research in Nursing & Health,* 32(2), 217-228. https://doi.org/10.1002/nur.20316

Lyndon, A. & Kenneday, H. P. (2010). Perinatal safety. From concept to nursing practice. *The Journal of Perinatal and Neonatal Nursing, 24*(1), 22-31. https://doi.org/10.1097/JPN.ObO13e3181cb9351

Martin, M. G., Keller, L. A., Long, T. L., & Ryan-Wenger, N. A. (2016). High-fidelity simulation effect on nurses' identification of deteriorating pediatric patients. *Clinical Simulation in Nursing, 12*(6), 228-239. https://doi.org/10.1016/j.ecns.2016.01.013

Messmer, P. R. (2008). Enhancing nurse-physician collaboration using pediatric simulation. *Journal of Continuing Education in Nursing, 39*(7), 319-327.

Meyer, G. A., Lavin, M. A., & Perry, A. G. (2007). Is it time for a new category of nursing diagnosis? *International Journal of Nursing Terminologies and Classifications, 18*(2), 45-50. https://doi.org/10.1111/j.1744-618X.2007.00049.x

Odell, M., Victor, C., & Oliver, D. (2009). Nurses' role in detecting deterioration in ward patients: Systematic literature review. *Journal of Advanced Nursing, 65*(10), 1992-2006. https://doi.org/10.1111/j.1365-2648.2009.05109.x

Patterson, M. D., Geis, G., LeMaster, T., & Wears, R. L. (2013). Impact of multidisciplinary simulation-based training on patient safety in a pediatric emergency department. *BMJ Quality & Safety, 22*(5), 383-393. https://doi.org/10.1136/bmjqs-2012-000951

Power, N., & Franck, L. (2008). Parent participation in the care of hospitalized children: A systematic review. *Journal of Advanced Nursing, 62*(6), 622-641. https://doi.org/10.1111/j.1365-2648.2008.04643.x

Sefton, G., McGrath, C., Tume, L., Lane, S., Lisboa, P. J. G., & Carrol, E. D. (2015). What impact did a paediatric early warning system have on emergency admissions to the paediatric intensive care unit? An observational cohort study. *Intensive and Critical Care Nursing, 31*(2), 91-99. https://doi.org/10.1016/j.iccn.2014.01.001

Shatzman, L. (1991). Dimensional analysis: notes on an alternative approach to the grounding of theory in qualitative research. In D. R. Maines ed., *Social Organization and Social Process. Essays in Honor of Anselm Strauss.* New York: Aldine De Gruyter.

Sherman, H., Castro, G., Fletecher, M., Hatlie, M., Hibbert, P., Jakob, R., . . .Virtanen, M. (2009). Towards an international classification for patient safety: the conceptual framework. *International Journal for Quality in Health Care, 21*(1), 2-8. https://doi.org/10.1093/intghc/mzn054

Shever, L. L. (2011). The impact of nursing surveillance on failure to rescue. Research and *Theory for Nursing Practice: An international journal, 25*(2), 107-126.

Shever, L. L., Titler, M., Dochterman, J., Fei, Q., & Picone, D. M. (2007). Patterns of nursing intervention use across 6 days of acute care hospitalization for three older patient populations. *International Journal of Nursing Terminologies and Classifications, 18*(1), 18-29. https://doi.org/10.111/j.1744-618X.2007.00044x

Shields, L. E., Wiesner, S., Klein, C., Pelletreau, B., & Hedriana, H. L. (2016). Use of maternal early warning trigger tool reduces maternal morbidity. *American Journal of Obstetrics and Gynecology, 214*(4), 527e1-e6. https://doi.org/10.1016/j.ajog.2016.01.154

Smith, D., Sekhon, M., Francis, J. J., & Aitken, L. M. (2019). How actionable are staff behaviours specified in policy documents? A document analysis of protocols for managing deteriorating patients. *Journal of Clinical Nursing, 00,* 1-11. https://doi.org/10.111/jocn.15005

Stockwell, D. C., Landrigan, C. P., Toomey, S. L., Loren, S. S., Jang, J., Ashrafzadeh, S.,…Schuster, M. A. (2018). Adverse events in hospitalized pediatric patients. *Pediatrics, 142*(2), 1-14. https://doi.org/10.1542/peds.2017-3360

Thomas, E. J., Taggart, B., Crandell, S., Lasky, R. E., Williams, A. L., Love, L. J.,…Helmreich, R. L. (2007). Teaching teamwork during the neonatal resuscitation program: A randomized trial. *Journal of Perinatology, 27*(7), 409-414. https://10.1038/sj.jp.7211771

Twycross, A., & Powls, L. (2006). How do children's nurses make clinical decisions? Two preliminary studies. Journal of Clinical Nursing, 15(10), 1324-1335. https://doi.org/10.1111/j.1365-2702.2006.01453.x

Van der Jagt, E. W. (2013). Improving pediatric survival from resuscitation events: the role and organization of hospital-based rapid response systems and code team. *Current Pediatric Reviews, 9*(2), 158-174. https://doi.org/10.2174/1573396311309020009

Weinstock, P. H., Kappus, L. J., Kleinman, M. E., Grenier, B., Hickey, P., & Burns, J. P. (2005). Toward a new paradigm in hospital-based pediatric education: The development of an onsite simulator program. *Pediatric Critical Care Medicine, 6*(6), 635-641. https://doi.org/10.1097/01.PCC.0000185489.07469.AF

Publishing Agreement

It is the policy of the University to encourage the distribution of all theses, dissertations, and manuscripts. Copies of all UCSF theses, dissertations, and manuscripts will be routed to the library via the Graduate Division. The library will make all theses, dissertations, and manuscripts accessible to the public and will preserve these to the best of their abilities, in perpetuity.

Please sign the following statement:

I hereby grant permission to the Graduate Division of the University of California, San Francisco to release copies of my thesis, dissertation, or manuscript to the Campus Library to provide access and preservation, in whole or in part, in perpetuity.

Author Signature

9/9/19
Date